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## **Subsolid Lung Nodules Pose Greater Cancer Risk to Women than Men**

### **AT A GLANCE**

- **Researchers reviewed data from the National Lung Screening Trial, a large, randomized control study that demonstrated the value of CT screening in reducing lung cancer mortality.**
- **The data showed that women were 50 percent more likely than men to have ground-glass, or hazy, lung nodules.**
- **Women with ground-glass lung nodules had a substantially higher risk of developing lung cancer, compared to men.**

CHICAGO – Women with a certain type of lung nodule visible on lung cancer screening CT exams face a higher risk of lung cancer than men with similar nodules, according to a new study being presented next week at the annual meeting of the Radiological Society of North America (RSNA).

Lung nodules are small masses of tissue in the lungs that are classified as solid or subsolid based on their appearance on CT. Solid nodules are dense, and they obscure adjacent tissue, while subsolid nodules are divided into two different types: part solid (nodules with both a solid component and a ground-glass, or hazy area), and pure ground glass, which are devoid of solid elements. Nodule consistency is considered an indicator of lung cancer risk, with part solid nodules being most strongly associated with lung cancer in the screening setting.

“We know there are differences in cancer risk among different lung nodule consistencies, but we were unaware of any published reports that looked at the differences in lung cancer risk for nodule subtypes between women and men,” said study lead author Phillip Boiselle, M.D., from Beth Israel Deaconess Medical Center and Harvard Medical School in Boston, Mass.

For the new study, Dr. Boiselle and colleagues reviewed CT scans from the National Lung Screening Trial (NLST), a large, randomized control study that demonstrated the value of CT screening in reducing lung cancer mortality. The NLST included more than 40 percent women, giving the research team a rare opportunity to look for statistically significant differences in lung nodules and lung cancer between the sexes.

The researchers characterized all CT-detected nodules measuring 4 to 30 millimeters by consistency using the NLST database and calculated the relative risk of developing a lung cancer for each nodule consistency subtype.

Out of 26,455 participants, 9,994, or 37.8 percent, had a positive screen at one or more points during the trial. Women with ground-glass nodules had a significantly higher relative risk of lung cancer than men with the same type of nodules, and a similar trend was observed for part-solid nodules. In contrast, the relative risk of lung cancer for solid nodules was comparable for both sexes.

Part-solid nodules had the highest predictive value of cancer in both sexes, whereas solid nodules had the lowest predictive value in women and ground glass nodules had the lowest predictive value in men.

“The main difference we found was that women were 50 percent more likely than men to have ground-glass nodules and, when these nodules were present, women had a substantially higher risk of developing lung cancer,” Dr. Boiselle said.

Current lung cancer screening guidelines do not take into account gender differences when managing nodules of different consistencies. While more research is needed before changes are made to clinical practice, the results suggest that women with ground glass nodules may need closer follow-up than men.

“By looking at the rate at which lung cancers grow on serial CT scans, we can develop a better understanding of how often to obtain follow-up CT scans in men and women,” Dr. Boiselle said.

The researchers plan to continue studying the NLST data to further understand the significance of these cancers, especially with respect to their influence on lung cancer mortality.

Co-authors on the study are Fenghai Duan, Ph.D., Stavroula Chysanthopoulou, Ph.D., Sarah DeMello, M.S., Denise R. Aberle, M.D., and Caroline Chiles, M.D.

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For patient-friendly information on CT screening for lung cancer, visit [RadiologyInfo.org](http://RadiologyInfo.org).

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## Ultrasound Reveals Knuckle-Cracking Fireworks

### AT A GLANCE

- **Researchers used ultrasound to analyze knuckle cracking in real time.**
- **The results suggest that the cracking sound and bright flash observed on ultrasound are related to the dynamic changes in pressure associated with a gas bubble in the joint.**
- **Physical examinations revealed no pain, swelling or disability in knuckles that were cracked.**

CHICAGO – Research presented today at the annual meeting of the Radiological Society of North America (RSNA) tackles one of life’s great mysteries: what causes a knuckle to “crack” out loud?

“It’s extremely common for joints to crack, pop and snap,” said Robert D. Boutin, M.D., professor of radiology at University of California, Davis (UC Davis) Health System. “We were interested in pursuing this study because there’s a raging debate about whether the knuckle-cracking sound results from a bubble popping in the joint or from a bubble being created in the joint.”

In the first study of its kind, researchers recorded simultaneous audio and visual evidence of knuckles

cracking. Forty healthy adults, including 17 women and 23 men (age range 18-63), were examined at UC Davis with ultrasound imaging, as they attempted to crack the knuckle at the base of each finger, known in medical parlance as the metacarpophalangeal joint (MPJ). The participants included 30 individuals with a history of habitual knuckle cracking and 10 without.

While some participants stated that they had never intentionally cracked their knuckles, other participants did it frequently every day – up to 20 times per day for the past 40 years.

Orthopedists blinded to the participants’ knuckle-cracking history evaluated the participants for grip strength, range of motion and laxity of each MPJ both before and after the ultrasound examination.

Using a small transducer, a sonographer recorded video images of 400 MPJs, as participants attempted to crack their knuckles. The sonographer also captured static images of each MPJ before and after participants tried their hands at cracking.

Two radiologists interpreted the ultrasound images, looking for sonographic evidence that would correlate with the audible cracks, which occurred in 62 of the 400 joints imaged.

“What we saw was a bright flash on ultrasound, like a firework exploding in the joint,” Dr. Boutin said. “It was quite an unexpected finding.”

Using the flashes on the ultrasound images, the radiologists were able to identify the joints with audible cracks with at least 94 percent specificity.

“There have been several theories over the years and a fair amount of controversy about what’s happening in the joint when it cracks,” Dr. Boutin said. “We’re confident that the cracking sound and bright flash on ultrasound are related to the dynamic changes in pressure associated with a gas bubble in the joint.” As for which comes first — the cracking sound or the flash of light — Dr. Boutin said that more research is needed.

The physical examinations revealed no immediate pain, swelling or disability in the knuckle-cracking group and no immediate difference in laxity or grip strength between the participants who cracked their knuckles and those who didn’t.

“We found that there was no immediate disability in the knuckle crackers in our study, although further research will need to be done to assess any long-term hazard – or benefit – of knuckle cracking,” Dr. Boutin said.

Co-authors on the study are Anuj Netto, M.D., M.P.H., David Nakamura, M.D., Cyrus Bateni, M.D., Michael S. Cronan, R.T., Robert Szabo, M.D., M.P.H., and Abhijit J. Chaudhari, Ph.D.

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**Medicaid Expansion Improves Breast Cancer Screening for Low-Income Women**

**AT A GLANCE**

- **Researchers found that Medicaid expansion improves breast cancer screening adherence for low-income women.**
- **States had the option of expanding Medicaid as part of the Affordable Care Act.**
- **In 2012, low-income women in expansion states were 25 percent more likely to be screened for breast cancer than in 2008.**

CHICAGO – Low-income women in Medicaid expansion states in the U.S. are more likely to have a breast screening performed than those in non-expansion states, according to a study presented today at the annual meeting of the Radiological Society of North America (RSNA).

As part of the Affordable Care Act (ACA), states had the option of expanding Medicaid to provide coverage to people under 65 years of age living at up to 133 percent of the federal poverty level (FPL). California, Connecticut, Minnesota, New Jersey and Washington, as well as Washington, D.C., were among the first to adopt and implement the expansion by 2011.

“While increased use of screening mammography has significantly contributed to improved detection of breast cancer, substantial disparities in breast cancer screening exist among populations in the country,” said the study’s lead author, Soudabeh Fazeli Dehkordy, M.D., M.P.H., from St. John Providence Hospital in Southfield, Mich. “We sought to determine whether increasing access to health insurance through Medicaid expansion has resulted in improved breast cancer screening adherence.”

Using data from the 2008 and 2012 Behavioral Risk Factor Surveillance System and adjusting for age, education, income and race, the analysis showed that low-income women in expansion states had a similar likelihood of being screened to those in non-expansion states in 2008. However, in 2012, after the early expander states implemented their programs, low-income women in expansion states were 25 percent more likely to be screened for breast cancer than in 2008.

“Understanding the impact of Medicaid expansion on breast cancer screening rates in early expander states can provide valuable insights that can be very useful to both state and federal policymakers when considering key health policy,” Dr. Fazeli Dehkordy said.

Currently, 23 states have opted to expand Medicaid coverage, while six others are implementing alternatives. The remaining states elected not to implement the expansion program or are still in the process of considering it.

“Adoption of Medicaid expansion by more states can result in considerable improvement of disparities in breast cancer screening, leading to better health outcomes for all women across the United States,” Dr. Fazeli Dehkordy said.

Co-authors on this study were Kelli Hall, Ph.D., Brady West, Ph.D., Vanessa Dalton, M.D., and Ruth C. Carlos, M.D., M.S.

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## Food Odors Activate Impulse Area of the Brain in Obese Children

### AT A GLANCE

- **Functional MRI exams show obesity has a neurological disorder component.**
- **Researchers studied 30 children, half of whom had a normal BMI between 19 and 24, and the other half exhibited a BMI over 30.**
- **In the obese children, areas of the brain connected to impulse and the development of obsessive-compulsive disorder were activated, while the areas of the brain associated with impulse control exhibited no activity.**

CHICAGO – The area of the brain associated with impulsivity and the development of obsessive-compulsive disorder is activated in obese children when introduced to food smells, according to a study being presented next week at the annual meeting of the Radiological Society of North America (RSNA).

“In order to fight obesity, it is crucial to understand the brain mechanisms of odor stimulus,” said Pilar Dies-Suarez, M.D., chief radiologist at the Hospital Infantil de México Federico Gómez. “This study has given us a better understanding that obesity has a neurological disorder component, and the findings have the potential to affect treatment of obese patients.”

In the United States, nearly 12.7 million children are obese, according to the Centers for Disease Control and Prevention (CDC). These children are at a higher risk to develop high blood pressure, type 2 diabetes, and breathing and joint problems, among many other health issues. They are also more likely to become obese adults.

The researchers studied 30 children between the ages of 6 and 10 years old. Half of the children had a normal body mass index (BMI) between 19 and 24, and the other half exhibited a BMI over 30, which is classified as obese. Each child was presented with three odor samples: chocolate, onion and a neutral odor of diluted acetone. As the participants smelled the samples, two MRI techniques—functional MRI (fMRI) and functional connectivity MRI (fcMRI)—were used to measure brain activity.

An evaluation of the fMRI results showed that in the obese children, the food odors triggered activation in the areas of the brain associated with impulse and the development of obsessive-compulsive disorder, while the areas of the brain associated with impulse control exhibited no activity. However, in the children with a normal BMI, the areas of the brain associated with pleasure regulation, organization and planning, as well as regions governing emotional processing or memory function, became more active.

In addition, the fMRI results showed that when the normal-weight children smelled the onion, there was a connection between the gustatory cortex, which processes taste, and the area of the brain linked to reward anticipation. This connection did not occur in the obese children.

The chocolate smell elicited significant brain connections in obese children, compared to the normal-weight children.

“If we are able to identify the mechanisms that cause obesity, we will be able to change the way we treat these patients, and in turn, reduce obesity prevalence and save lives,” Dr. Dies-Suarez said.

Co-authors on this study were Silva Hidalgo-Tobon, Ph.D., Benito De Celis IV, Eduardo Barragan, Eduardo Castro, M.D., Samuel Flores, M.D., Porfirio Ibanez and Manuel Obregon.

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**Researchers Use Gaming Technology to Create Better X-Rays**

**AT A GLANCE**

- **Software developed for Microsoft Kinect can automatically measure body thickness, and check for motion and positioning prior to X-ray imaging.**
- **Through real-time monitoring, the software alerts the user to factors that could compromise image quality.**
- **Patients will benefit from reduced radiation exposure and higher quality images to ensure diagnostic accuracy.**

CHICAGO – Researchers have developed software for the Microsoft Kinect gaming console that measures body part thickness and checks for motion, positioning and beam adjustment immediately before X-ray imaging, according to a feasibility study presented today at the annual meeting of the Radiological Society of North America (RSNA).

“Patients, technologists and radiologists want the best quality X-rays at the lowest dose possible without repeating images,” said Steven Don, M.D., associate professor of radiology at Mallinckrodt Institute of Radiology, Washington University School of Medicine in St. Louis, Mo. “This technology is a tool to help achieve that goal. Patients will benefit from reduced radiation exposure and higher quality images to ensure diagnostic accuracy.”

Microsoft Kinect was originally developed as a motion sensor and facial and voice recognition device for the Xbox gaming system that enabled players to play games without a standard controller. Subsequently, the technology has been adapted for select non-gaming applications.

For this feasibility study, Dr. Don and colleagues combined the technology of the Microsoft Kinect 1.0 with proprietary software to address common problems that affect imaging results, including body-part thickness and motion.

“To optimize radiation exposure and image quality, X-ray technique should be set based on body-part thickness,” Dr. Don explained. “Use of traditional calipers is time-consuming, intrusive, and sometimes frightening to young children. Using Microsoft Kinect with this software, we can measure body-part thickness automatically without patient contact.”

Additionally, the software provides valuable information on motion and positioning with respect to automatic exposure control (AEC) sensors, image receptor and body part within the X-ray field.

Through real-time monitoring, the software alerts the user when any of these factors do not match the requisition—such as the wrong body part—or could compromise image quality. This fail-safe helps to reduce or eliminate common causes of unnecessary repeat image acquisition.

“This device can help technologists and radiologists achieve the radiation dose goal of ALARA, As Low As Reasonably Achievable, while enhancing the quality and consistency of X-ray images,” Dr. Don said.

Dr. Don noted that the radiology research community is constantly improving imaging for patients to ensure accurate diagnoses while striving to reduce dose.

“In the future, we hope to see this device, and other tools like it, installed on radiography equipment to aid technologists by identifying potential problems before they occur,” he said.

Co-authors on the study are Robert MacDougall, M.Sc., and William Clayton.

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## **MRI Reveals Heart Changes During Apnea in Elite Divers**

### **AT A GLANCE**

- **Free diving is an increasingly popular sport in which divers descend to great depths without breathing for several minutes.**
- **MRI shows that during a long apnea period, the heart struggles and eventually begins to fail.**
- **The changes to heart function are transient in elite divers but could be harmful for improperly trained divers or people with cardiac or other medical conditions.**

CHICAGO – Athletes who engage in the extreme sport of free diving, descending hundreds of feet below the surface of the ocean while holding their breath, undergo significant cardiovascular changes, according to a new study presented today at the annual meeting of the Radiological Society of North America (RSNA). These changes can pose potential dangers, particularly to inexperienced or cardiac untrained divers.

Apnea is the temporary suspension of breathing. The ancient practice of free or apnea diving has experienced immense growth worldwide over the past decade, due to coverage in the media and increased competition and training opportunities for elite and recreational divers. The sport can be dangerous, because divers must hold their breath for prolonged periods while undergoing massive water pressure and physiological changes.

Recreational divers are at greatest risk because of lack of conditioning, but even elite divers have suffered lasting or fatal effects resulting from free diving. Most recently, champion diver Natalia Molchanova was reported missing and presumed dead off the coast of Spain during a dive in August 2015.

Researchers at the University of Bonn in Bonn, Germany, used MRI to study the simulated effects of free diving on the cardiovascular systems of 17 elite free divers from Germany and Austria (age range 23 to 58). To study the effects of a lack of oxygen on heart function and blood flow, respectively, the divers underwent cardiac MRI and MRI of the carotid arteries before, during and after a maximum breath hold.

“We wanted to look at the changes that occur in the heart during apnea in real time,” explained study author Jonas Dörner, M.D., who is now a radiology resident at the University Hospital of Cologne.

The average apnea was 299 seconds (just under five minutes) and 279 seconds or about four and a half minutes for the first and second MRI exams, respectively. The maximum breath hold (or apnea) during the exams was eight minutes and three seconds.

“These athletes train to be able to hold their breath for long periods,” Dr. Dörner said. “When they get into the water, they are able to hold their breath even longer due to the diving reflex.”

When submerged underwater without access to oxygen, the body responds with what is called “diving reflex,” which includes a decreased heart rate, a constriction of blood vessels in the extremities, and a shift in blood flow from the extremities to the brain. These changes also occur – to a lesser degree – during prolonged breath holding without being submerged. As oxygenated blood is diverted from the rest of the body to the brain, blood pressure increases.

The MRI exams allowed the researchers to observe the cardiovascular changes involved in the diving reflex in real time. During apnea, the amount of blood flowing to the brain through the carotid arteries increased and then leveled off.

“At the beginning of the apnea period, the heart pumped more strongly than when the heart was at rest,” Dr. Dörner said. “Over time, the heart dilated and began to struggle.”

By the end of the apnea period, Dr. Dörner said the divers’ heart function began to fail.

“At that point, not enough blood is being pumped to the brain,” he said. “The heart is unable to pump against the high resistance of the blood vessels.”

Although the changes in the divers’ systolic heart function during apnea are similar to those in patients with systolic heart failure, Dr. Dörner said that the condition was transient in the divers.

“The divers’ heart function recovered within minutes of breathing again,” said Claas Nähle, M.D., head of this cardiac magnetic resonance research group. “It appears that elite divers develop compensatory mechanisms that help them adapt to the cardiovascular changes that occur during apnea.”

However, for individuals with less training, free diving may be problematic.

“As a recreational activity, free diving could be harmful for someone who has heart or other medical conditions and is not well trained for the activity,” said one of the study’s leaders, Lars Eichhorn, M.D., from the Department of Anesthesiology and Intensive Care Medicine at the University Hospital of Bonn.

Dr. Eichhorn added that deaths among highly trained divers are mostly seen in the discipline called deep diving, a special type of apnea diving that combines the risk of prolonged apnea with changes of ambient pressure.

Other co-authors on the study are Jean-Marc Lunkenheimer, Julian A. Luetkens, M.D., Juergen Gieseke, D.Sc., Rainer Meyer, Ph.D., Andreas Hoeft, M.D., and Hans H. Schild, M.D.

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## MRI Reveals Weight Loss Protects Knees

### AT A GLANCE

- **Obese patients who lose weight can slow down the progression of cartilage degeneration in the knee.**
- **Researchers investigated the association between different degrees of weight loss and the progression of knee cartilage degeneration in 506 overweight and obese patients.**
- **Patients who lost more than 10 percent of their body weight had slower degeneration of their knee cartilage.**

CHICAGO – Obese people who lose a substantial amount of weight can significantly slow the degeneration of their knee cartilage, according to a new MRI study presented today at the annual meeting of the Radiological Society of North America (RSNA).

Obesity is a major risk factor for osteoarthritis, a degenerative joint disease that affects more than a third of adults over the age of 60, according to the Centers for Disease Control and Prevention. The knee joint is a common site of osteoarthritis, and in many people the condition progresses until total knee replacement becomes necessary. Aging baby boomers and a rise in obesity have contributed to an increased prevalence of knee osteoarthritis.

“Degenerative joint disease is a major cause of pain and disability in our population, and obesity is a significant risk factor,” said the study’s lead author, Alexandra Gersing, M.D., from the Department of Radiology and Biomedical Imaging at the University of California, San Francisco. “Once cartilage is lost in osteoarthritis, the disease cannot be reversed.”

Dr. Gersing and colleagues recently investigated the association between different degrees of weight loss and the progression of knee cartilage degeneration in 506 overweight and obese patients from the Osteoarthritis Initiative, a nationwide research study focused on the prevention and treatment of knee osteoarthritis. The patients either had mild to moderate osteoarthritis or risk factors for the disease. They were divided into three groups: a control group who did not lose weight, a second group who lost a little weight, and a third group who lost more than 10 percent of their body weight. The researchers then used MRI to quantify knee osteoarthritis.

“Through T2 relaxation time measurements from MRI, we can see changes in cartilage quality at a very early stage, even before it breaks down,” Dr. Gersing said.

When the researchers analyzed differences in the quality of cartilage among the three groups over a four-year time span, they found evidence that weight loss has a protective effect against cartilage degeneration and that a larger amount of weight loss is more beneficial.

“Cartilage degenerated a lot slower in the group that lost more than 10 percent of their body weight, especially in the weight-bearing regions of the knee,” Dr. Gersing said. “However, those with 5 to 10 percent weight loss had almost no difference in cartilage degeneration compared to those who didn’t lose weight.”

Substantial weight loss not only slows knee joint degeneration—it also reduces the risk of developing osteoarthritis, Dr. Gersing said. Along with moderate exercise, weight loss is one of the primary interventions against the disease.

“It’s most helpful if these lifestyle interventions take place as early as possible,” Dr. Gersing said.

In the future, the researchers are planning to study the role of diabetes, which is closely linked with obesity, in cartilage degeneration. They also plan to do an eight-year follow-up with the patient group and look at what effects weight gain may have on the knee joint.

Co-authors on the study are Martin Solka, Gabby B. Joseph, Ph.D., Benedikt J. Schwaiger, M.D., Ursula R. Heilmeyer, M.D., Georg Feuerriegel, John Mbapte Wamba, M.D., Charles E. McCulloch, Ph.D., Michael C. Nevitt, Ph.D., and Thomas M Link, M.D., Ph.D.

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*Embargoed for release on Thursday, Dec. 3, 2015, at 12:01 a.m. ET*

## Patient Mood Can Impact Medical Procedure Results

### AT A GLANCE

- **Patients' negative feelings prior to interventional treatments may affect outcomes of the procedure.**
- **Researchers analyzed the results of 230 patients who underwent image-guided interventional radiology procedures, including vascular and kidney interventions.**
- **Patients reporting a high degree of negative feelings prior to the procedure experienced significantly more adverse events, such as changes in blood pressure and heart rate or post-operative bleeding, during or immediately following the procedure.**

CHICAGO – Feeling high levels of distress, fear and hostility prior to undergoing an angioplasty or other interventional radiology procedure may lead to a poor outcome, according to new research presented today at the annual meeting of the Radiological Society of North America (RSNA).

“I was surprised by this result,” said study author Nadja Kadom, M.D., currently acting associate professor of radiology at Emory University School of Medicine and Children’s Healthcare of Atlanta. “Prior to this study, I did not believe patient mood could have an effect on outcome.”

In the study, researchers analyzed the results of 230 patients, including 120 women and 110 men (mean age 55 years) who underwent image-guided interventional radiology procedures including vascular and kidney interventions. The minimally invasive procedures

involved the use of a catheter, which is inserted through a blood vessel and threaded to an area of the body, such as a blocked artery, for treatment.

Upon arriving for their procedure, patients were asked to complete a questionnaire called the Positive Affect Negative Affect Schedule (PANAS) to assess their mood. Using a five-point rating scale, the patients reported to what extent they felt strong, alert, determined and other positive feeling states and to what degree they were experiencing negative feelings, such as guilt, nervousness or irritability.

Dr. Kadom and fellow researchers Elvira V. Lang, M.D., Ph.D., and Gheorghe Doros, Ph.D., grouped the patients based on high and low scores for positive affect and high and low scores for negative affect. Those groups were then correlated with the occurrence of adverse events during the procedures, such as a prolonged lack of oxygen, low or high blood pressure, post-operative bleeding or an abnormally slow heart rate.

A statistical analysis of the data revealed that patients with a high negative affect experienced significantly more adverse events than patients with low negative affect. Of the 104 patients with high negative affect, 23 (22 percent) had an adverse event, compared to 15 (12 percent) of the 126 patients with low negative affect. The degree of positive affect did not make a significant difference in the incidence of adverse events.

“Our study shows that mood matters,” noted Dr. Lang, an interventional radiologist in Boston. “You don’t need to have a chipper, cheery attitude prior to your procedure. You just have to overcome negative emotions and get to a neutral level.”

Unlike surgical procedures in which patients are not conscious, interventional radiology procedures are often performed on patients who are sedated but awake and able to talk with the physician and healthcare team.

“This is a real issue,” Dr. Lang said. “The procedure room is a two-way street in which the patient can affect the healthcare professional and vice versa. Any time the team must manage an adverse event, it takes attention away from the procedure.”

Dr. Kadom said that although the tendency in radiology is to focus on improving equipment and techniques to minimize adverse outcomes, there is a growing awareness of what patients bring to the table.

Dr. Lang suggested that healthcare teams should be trained in resilience and techniques to create their own positive emotional states, as well as coping strategies to help patients modify negative emotions and reframe their mindset prior to undergoing a procedure.

“We need to help staff show patients how to manage their own emotions to help create an environment for a better outcome,” she said.

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*Embargoed for release on Wednesday, Dec. 2, 2015, at 12:01 a.m. ET*

## **Study Suggests Breast Density Alone Not a Risk Factor for Cancer**

### **AT A GLANCE**

- **Contrary to recent reports, a new study found that high breast density was not a strong independent risk factor for breast cancer.**
- **Researchers looked at data from 52,962 mammography exams performed in women ages 50 to 69 over five years.**
- **Of 230 detected breast cancers, almost half were from the group with the lowest category of breast density, while slightly less than 3 percent came from women in the highest breast density category.**

CHICAGO – Breast density may not be a strong independent factor for breast cancer risk, according to a new study presented today at the annual meeting of the Radiological Society of North America (RSNA).

Prior research has shown an association between breast density and breast cancer. In addition, cancers in dense breast tissue are more difficult to see on mammograms. As a result, some women with dense breasts are advised to get supplementary screening with ultrasound or MRI. Some U.S. states have enacted legislation mandating breast density reporting to women undergoing mammography.

“In our study, we found that there was no significant difference in breast density between breast cancer

patients and the control group in the screening program,” said Natasa Katavic, M.D., from the Department of Radiology at Health Center Osijek in Osijek, Croatia.

For the study, Dr. Katavic and colleagues looked at data from 52,962 mammography exams performed in women ages 50 to 69 over five years at five different mammography facilities. Women in Croatia in this age group are invited every two years for mammography by the country’s Institute of Public Health.

“We wanted to find out if breast cancer patients had more dense breast tissue than the healthy women,” Dr. Katavic said. “Also, we wanted to see what the percentage of dense breasts was in our postmenopausal population and, consequently, determine the value of mammography screening for this group.”

Two radiologists read the mammograms independently and determined breast density according to standard criteria. The researchers compared data between patients in the low-density breast tissue group and the high-density group.

The majority of screened woman had low breast density. Of the 230 detected breast cancers, almost half were from the group with the lowest ranked breast density, while slightly less than 3 percent came from women in the highest breast density category.

When the researchers matched the women who had a detected cancer with control participants of the same age and from the same locales who did not have cancer, they found no significant difference in mammographic density. Women with low mammographic density made up 83 percent of the patients in the breast cancer group, compared with 89 percent in the control group, while high mammographic density was found in 17 percent of the breast cancer patients and 11 percent of women in the control group.

The study did not find a strong association between higher mammographic densities and a higher risk of breast cancer among postmenopausal women, according to Dr. Katavic.

“Our study suggests that breast density alone might not be strong independent risk factor for breast cancer,” she said. “In risk assessment, all risk factors should be considered before decisions on additional examinations.”

The findings also support mammography as an efficient method for early detection of non-palpable breast cancer, Dr. Katavic said.

Co-authors on the study are Kristina Bojanic, M.D., Prof. Kristina Kralik, Tibor Santo, M.D., Kristina Vidacic, M.D., Mirta Pacovski, M.D., and Miroslav Sikora, D.M.D.

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## CT and 3-D Printing Aid Surgical Separation of Conjoined Twins

### AT A GLANCE

- **For the first time, CT imaging and 3-D printing technology have been combined to help plan the surgical separation of conjoined twins.**
- **Researchers performed volumetric CT imaging on both twins to view vital structures and plan how to separate them so that both twins could survive.**
- **The 3-D models proved to be an excellent source of information, as there were no major discrepancies between the models and the twins' actual anatomy.**

CHICAGO – A combination of detailed CT imaging and 3-D printing technology has been used for the first time in the surgical planning for separation of conjoined twins, according to a study presented today at the annual meeting of the Radiological Society of North America (RSNA).

Conjoined twins, or twins whose bodies are connected, account for approximately one of every 200,000 live births. Survival rates are low and separating them through surgery is extremely difficult because they often share organs and blood vessels.

Specialists at Texas Children's Hospital in Houston brought a new approach to these challenges when they set out to surgically separate Knatalye Hope and Adeline Faith Mata, conjoined twins from Lubbock, Texas. Knatalye and Adeline were born on April 11, 2014, connected from the chest all the way down to the pelvis.

"This case was unique in the extent of fusion," said the study's lead author, Rajesh Krishnamurthy, M.D., chief of radiology research and cardiac imaging at Texas Children's Hospital. "It was one of the most complex separations ever for conjoined twins."

To prepare for the separation surgery, Dr. Krishnamurthy and colleagues performed volumetric CT imaging with a 320-detector scanner, administering intravenous contrast separately to both twins to enhance views of vital structures and help plan how to separate them to ensure survival of both children. They used a technique known as target mode prospective EKG gating to freeze the motion of the hearts on the images and get a more detailed view of the cardiovascular anatomy, while keeping the radiation exposure low.

"The CT scans showed that the babies' hearts were in the same cavity but were not fused," Dr. Krishnamurthy said. "Also, we detected a plane of separation of the liver that the surgeons would be able to use."

The team translated the CT imaging results into a color-coded physical 3-D model with skeletal structures and supports made in hard plastic resin, and organs built from a rubber-like material. The livers were printed

as separate pieces of the transparent resin, with major blood vessels depicted in white for better visibility. The models were designed so that they could be assembled together or separated during the surgical planning process. The surgical team used the models during the exhaustive preparation process leading up to the surgery.

On February 17, a little more than 10 months after they were born, the Mata twins underwent surgical separation by a team of more than 26 clinicians, including 12 surgeons, six anesthesiologists and eight surgical nurses. The official separation took place approximately 18 hours into the 26-hour surgery.

The 3-D models proved to be an excellent source of information, as there were no major discrepancies between the models and the twins' actual anatomy.

“The surgeons found the landmarks for the liver, hearts and pelvic organs just as we had described,” Dr. Krishnamurthy said. “The concordance was almost perfect.”

Dr. Krishnamurthy expects the combination of volumetric CT, 3-D modeling, and 3-D printing to become a standard part of preparation for surgical separation of conjoined twins, although barriers remain to its adoption.

“The 3-D printing technology has advanced quite a bit, and the costs are declining. What’s limiting it is a lack of reimbursement for these services,” he said. “The procedure is not currently recognized by insurance companies, so right now hospitals are supporting the costs.”

Besides assisting clinicians prepare for surgery, the 3-D model also served another important function: helping the twins' parents, Elysse and John Eric Mata, understand the process.

“When I showed the mother the model and explained the procedure, she held my hand and thanked me,” Dr. Krishnamurthy recalled. “They said, ‘For the first time, we understand what is going to happen with our babies.’”

Knatalye Hope returned home in May 2015 and her sister Adeline Faith came home a month later. They are both doing well and have a Facebook page, “Helping Faith & Hope Mata,” with updates on their progress.

Co-authors on the study are Nicholas Dodd, B.S., Darrell Cass, M.D., Amrita Murali and Jayanthi Parthasarathy, B.D.S., M.S., Ph.D.

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### **3-D MRI Shows Early Signs of Stroke Risk in Diabetic Patients**

#### **AT A GLANCE**

- **Researchers used 3-D MRI to study the carotid arteries in diabetic patients for evidence of intraplaque hemorrhage (IPH), an indicator of advanced atherosclerotic disease.**
- **Thirty-seven of the 159 patients imaged had IPH in at least one carotid artery, five of which had IPH in both carotid arteries.**
- **IPH was found in the absence of carotid artery stenosis and was associated with an increased carotid artery wall volume.**

CHICAGO – People with diabetes may be harboring advanced vascular disease that could increase their risk of stroke, according to new research being presented next week at the annual meeting of the Radiological Society of North America (RSNA). The findings suggest that arterial imaging with 3-D MRI could be useful in helping to determine stroke risk among diabetics.

The carotid arteries are vessels on each side of the neck that supply oxygenated blood to the head. Narrowing of the carotid arteries is associated with risk of stroke, but less is known about stroke risk in people with little or no narrowing of these arteries.

For the new study, researchers used 3-D MRI to study the carotid arteries for evidence of intraplaque hemorrhage (IPH), an indicator of advanced atherosclerotic disease.

“A recent analysis of multiple studies has shown that people with carotid artery narrowing and IPH have a five- to six-times higher risk of stroke in the near future compared to people without,” said study author Tishan Maraj, M.B.B.S., imaging analyst at Sunnybrook Research Institute and M.Sc. candidate at the University of Toronto in Toronto, Canada.

Dr. Maraj and colleagues focused their study on people with diabetes, a group already facing a significantly increased risk of strokes with worse outcomes than the non-diabetic population. They used 3-D MRI to investigate the prevalence of carotid IPH in 159 asymptomatic type 2 diabetic patients, average age 63, recruited from a dietary trial between 2010 and 2013.

Of the 159 patients imaged, 37, or 23.3 percent, had IPH in at least one carotid artery. Five of the 37 patients had IPH in both carotid arteries. IPH was found in the absence of carotid artery stenosis, or narrowing, and was associated with an increased carotid artery wall volume as measured by 3-D MRI.

“It was surprising that so many diabetic patients had this feature,” Dr. Maraj said. “We already knew that people with diabetes face three to five times the risk of stroke, so perhaps IPH is an early indicator of stroke risk that should be followed up.”

While 2-D MRI has been used for more than a decade to identify and characterize carotid artery plaques, the 3-D method brings an extra level of imaging power, Dr. Maraj noted.

“The advantage of 3-D MRI is you can image the entire carotid artery and pinpoint the area of interest over a shorter period of time compared with multiple 2-D sequences,” he said.

Dr. Maraj emphasized that the study did not look at outcomes for the patients and did not draw any conclusions on whether people with IPH will develop carotid artery blockages more quickly than those with no IPH present. However, it is already known that blood is a destabilizing factor of plaque that promotes rupture, setting off a chain of events that can lead to a stroke.

Although there is no treatment for IPH at this time, Dr. Maraj said identification of it may help with risk stratification and could even have applications in the non-diabetic population.

“Even though you can’t treat IPH, you can monitor patients a lot more closely,” he said.

Co-authors on the study are Alan R. Moody, M.D., FRCP, FRCR, Navneet Singh, M.D., Tina Binesh Marvasti, M.Sc., Mariam Afshin, Ph.D., M. Eng., Pascal N. Tyrrell, Ph.D., and David Jenkins, M.D., Ph.D., D.Sc.

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**Imaging Yields Evidence of Heart Disease in Archeological Find**

**AT A GLANCE**

- **Preserved hearts dating back to the late 16th century to early 17th century were examined using modern imaging techniques.**
- **Using MRI and CT, researchers were able to identify different heart structures, such as chambers, valves and coronary arteries.**
- **Plaque and atherosclerosis were found on three of the preserved hearts, leading researchers to believe that present-day health conditions existed in the past.**

CHICAGO – Researchers using modern imaging techniques on hearts more than 400 years old found at an archeological site were able to learn about the health conditions of the people buried there, according to a new study presented today at the annual meeting of the Radiological Society of North America (RSNA).

Archaeologists with the National Institute for Preventive Archaeological Research excavating the basement of the Convent of the Jacobins in Rennes, France, unearthed several grave sites dating back to the late 16th or early 17th century.

Among the items unearthed in the burial vaults of elite-class families were five heart-shaped lead urns. Inside each urn was a preserved human heart. A team of

radiologists, including one with a background in forensics, was called in to examine the hearts. Additional researchers, including forensic physicians, archeologists, pathologic physicians and physicists, were brought in from the Molecular Anthropology and Synthesis Imaging and the Institute of Metabolic and Cardiovascular Diseases.

The research team used MRI and CT to obtain clinical images of the hearts. While the images were impressive, due to the embalming materials used to preserve the hearts, very little health information could be obtained.

“We tried to see if we could get health information from the hearts in their embalmed state, but the embalming material made it difficult,” said study author Fatima-Zohra Mokrane, M.D., radiologist at Rangueil Hospital at the University Hospital of Toulouse in France. “We needed to take necessary precautions to conduct the research carefully in order to get all possible information.”

The research team carefully cleaned the hearts, removing the embalming material. MRI and CT scans were redone. On the new set of CT images, researchers were able to identify the different heart structures, such as chambers, valves and coronary arteries. Once the tissue was rehydrated, researchers

were better able to identify myocardial muscles with MRI. Classic techniques, such as dissection, external study and histology, were also used to examine the heart tissues.

One heart appeared healthy and showed no signs of disease. Three of the hearts did show signs of disease, as plaque was found on the coronary arteries. The fifth heart had been poorly preserved and, therefore, could not be studied.

“Since four of the five hearts were very well preserved, we were able to see signs of present-day heart conditions, such as plaque and atherosclerosis,” Dr. Mokrane said.

During the excavation, the archeologists and the research team also discovered that the heart of one male—later identified by an inscription on one of the lead urns as Toussaint Perrien, Knight of Brefeillac—had been removed upon his death and later buried with his wife, Louise de Quengo, Lady of Brefeillac, whose preserved body was also found at the site.

“It was common during that time period to be buried with the heart of a husband or wife,” Dr. Mokrane said. “This was the case with one of our hearts. It’s a very romantic aspect to the burials.”

Co-authors on the study are Rozenn Colleter, Ph.D., Sylvie Duchesne, Ph.D., Ramiro Moreno, Ph.D., Anou Sewonu, Ph.D., Herve P. Rousseau, Ph.D., Eric Crubezy, M.D., Ph.D., Norbert Telmon, M.D., Ph.D., and Fabrice Dedouit, M.D., Ph.D.

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*Embargoed for release on Monday, Nov. 30, 2015, at 12:01 a.m. ET*

**Imaging Identifies Cartilage Regeneration in Long-Distance Runners**

**AT A GLANCE**

- **Researchers used a mobile MRI scanner to study the effects of ultra-endurance running over a 64-day period.**
- **The results showed that ankle and foot cartilage have the ability to regenerate even under ongoing stress.**
- **MRI also revealed 6.1% loss of gray matter brain volume in the runners over the course of the race.**

CHICAGO – Using a mobile MRI truck, researchers followed runners for 4,500 kilometers through Europe to study the physical limits and adaptation of athletes over a 64-day period, according to a study presented today at the annual meeting of the Radiological Society of North America (RSNA).

“The fact that ultra-distance running places stress on the body has been well documented,” said Uwe Schütz, M.D., a radiologist and specialist in orthopedics and trauma surgery in the Department of Diagnostic and Interventional Radiology at the University Hospital of Ulm in Germany. “Our research provides detailed information on how the various organ systems change and adapt in response to that stress.”

The Trans Europe Foot Race (TEFR) took place from April 19 to June 21, 2009. It entailed running 4,487 km starting in southern Italy and ending in the North Cape in Norway without any day of rest. Forty-four of the runners (66 percent) agreed to participate in the study.

The research team’s most important tool was a 1.5 Tesla MRI scanner mounted on a mobile unit, the only one of its kind in Europe at that time. Each participant was scanned every three to four days, resulting in 15 to 17 MRI exams over the course of the race. The runners were also randomly assigned to additional examinations, and protocols were created for daily urine, blood and other tests.

The results showed that with exception to the patellar joint, nearly all cartilage segments of knee, ankle and hind-foot joints showed a significant degradation within the first 1,500 to 2,500 kilometers of the race.

“Interestingly, further testing indicated that ankle and foot cartilage have the ability to regenerate under ongoing endurance running,” Dr. Schütz said. “The ability of cartilage to recover in the presence of loading impact has not been previously shown in humans. In general, we found no distance limit in running for the human joint cartilage in the lower extremities.”

MRI investigations of the soft tissues and bones of the ultra-runners' feet showed a significant increase of the diameter of the Achilles tendon. "We found no relevant damage to bone or soft tissues in the 44 runners," Dr. Schütz said. "The human foot is made for running."

The researchers also looked at how ultramarathon running affects brain volume. Baseline comparison of TEFr participants and controls revealed no significant differences in gray matter volume. At the end of the race, MRI of the brain revealed about a 6.1 percent loss of gray matter volume in the runners. After eight months, gray matter volume had returned to normal levels.

Although the finding on gray matter volume loss while running is astonishing, Dr. Schütz said, it is not cause for alarm.

"Despite substantial changes to brain composition during the catabolic stress of an ultramarathon, we found the differences to be reversible and adaptive," he said. "There is no lasting brain injury in trained athletes participating in ultra-running."

Co-authors on the study are Christian Billich, M.D., Jutta Ellermann, M.D., Ph.D., Martin Ehrhardt, M.D., Daniel Schoss, M.D., Martin Brix, M.D., Siegfried Trattnig, M.D., Ph.D., Sabine Goed, M.D., Antje Reiner, M.D., and Meinrad J. Beer, M.D., Ph.D.

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## **Gastric Artery Embolization Shows Promise in Treating Obesity**

### **AT A GLANCE**

- **Five patients were approved for this pilot study of an FDA-approved interventional technique that shows promise for helping morbidly obese patients lose weight.**
- **Patients who have undergone the treatment have lost weight, including one patient who is diabetic.**
- **The researchers followed a strict protocol, monitoring the patients' quality of life and taking blood samples to make sure the patients weren't becoming anemic.**

CHICAGO – An interventional radiology technique shows promise for helping morbidly obese patients lose weight, according to the preliminary results of a study being presented today at the annual meeting of the Radiological Society of North America (RSNA).

Gastric artery embolization has been done for decades by interventional radiologists as a way to stop bleeding in emergency situations, but the idea of performing the procedure as a means of treating obesity is new.

“We are showing early results that this procedure is safe and potentially efficacious for the treatment of morbid obesity,” said Mubin Syed, M.D., interventional radiologist at Dayton Interventional Radiology in Dayton, Ohio.

The new approach arose from the 1999 discovery of an appetite-stimulating hormone called ghrelin that is made in the stomach. Rising levels of ghrelin are one reason that people have trouble sticking with a diet.

In order to suppress production of ghrelin, interventional radiologists embolize the gastric artery, the main artery that supplies blood to the stomach. Embolization is performed by injecting microscopic beads into the bloodstream. The beads make their way to the artery, where they block the smaller vessels. This is all accomplished through a minimally invasive non-surgical technique through a small catheter inserted in the wrist or groin.

After reading about promising results in animal studies and preliminary research in humans, Dr. Syed set out to bring the approach to Ohio, which has some of the highest levels of obesity in the nation.

Dr. Syed was able to conduct the trial through an Investigational Device Exemption (IDE) from the U.S. Food and Drug Administration (FDA). The FDA approved the pilot study—the Gastric Artery Embolization Trial for Lessening Appetite Nonsurgically (GET LEAN)—for five morbidly obese patients with a body mass index of 40 or higher, who had failed previous attempts at weight loss through diet, exercise and behavior modification.

The initial patient in the study represented the first use of left gastric artery embolization in the Western Hemisphere to treat morbid obesity. All the patients were treated on an outpatient basis. The researchers followed a strict protocol, monitoring the patients' quality of life and taking blood samples to ensure the patients' well-being.

Three patients lost weight, including one person who, at a height of only 4 feet 11 inches, lost 50 pounds in nine months. The second and third patients experienced mild weight loss and a fourth patient, who had lost 26 pounds at her three-month follow-up, became the first diabetic to undergo the procedure.

“This is important, because diabetes is strongly associated with obesity,” Dr Syed said. “We’ve shown that the procedure was feasible in a diabetic patient.”

While previous embolizations used the groin for access, Dr. Syed was the first to introduce the embolic agents through the radial artery in the wrist—a safer, more convenient access site in the obese population.

“In obese patients, the groin can be difficult to access,” he said. “Our method is also potentially easier for patients, because they won’t have to lie flat for long.”

People with a previous bypass or embolization are not eligible for gastric artery embolization, and patients with recurrent depression may not benefit from the approach.

“Depressed patients are supposed to be excluded from the study because antidepressants can cause weight gain, and depressed patients often eat when they’re not hungry,” Dr. Syed said.

The research is still in its early stages and more results are needed before the method comes into clinical use. Gastric bypass, a procedure in which the stomach volume is surgically reduced, remains the standard treatment for morbidly obese patients who have failed other interventions.

Still, the initial results are an encouraging sign of a possible new weapon against obesity.

“We’re seeing good results so far,” Dr. Syed said. “We’ve had no major adverse events, and we hope to study more patients in the future with the same or different embolic agents.”

The researchers are still in the process of selecting a fifth patient for the study.

Co-authors on the study are Kamal Morar, M.D., Azim Shaikh, M.D., M.B.A., Paul Craig, M.D., M.A., Talal Akhter, M.D., Hooman Khabiri, M.D., and Omar Khan.

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## Reduced Blood Flow Seen in Brain After Clinical Recovery of Acute Concussion

### AT A GLANCE

- **Researchers studied concussed football players with an advanced MRI method that detects blood flow in the brain.**
- **Concussed players demonstrated significant blood flow reduction in the brain after clinical recovery.**
- **According to the National Institutes of Health, sports are second only to motor vehicle crashes as the leading cause of traumatic brain injury among people aged 15 to 24 years.**

CHICAGO – Some athletes who experience sports-related concussions have reduced blood flow in parts of their brains even after clinical recovery, according to a study presented today at the annual meeting of the Radiological Society of North America (RSNA). The results suggest a role for MRI in determining when to allow concussed athletes to return to competition.

Concussions affect millions of people each year and are especially prevalent in contact sports like football. Sports are second only to motor vehicle crashes as the leading cause of traumatic brain injury among people between 15 and 24 years old, according to the National Institutes of Health.

Decisions to clear concussed athletes to return to action are typically based on symptoms and cognitive and neurological test results. However, there is increasing evidence that brain abnormalities persist beyond the point of clinical recovery after injury.

To find out more, researchers from the Medical College of Wisconsin in Milwaukee studied concussed football players with arterial spin labeling, an advanced MRI method that detects blood flow in the brain.

“This measurement of blood flow is fully noninvasive, without radiation exposure,” said study author Yang Wang, M.D., Ph.D., associate professor of radiology at the Medical College of Wisconsin. “We use arterial blood water as a contrast tracer to measure blood flow change, which is highly associated with brain function.”

Dr. Wang and colleagues studied 18 concussed players and 19 non-concussed players. They obtained MRI of the concussed players within 24 hours of the injury and a follow-up MRI eight days after the injury and compared results with those of the non-concussed players. Clinical assessments were obtained for both groups at each time point, as well as at the baseline before the football season.

The concussed players demonstrated significant impairment on clinical assessment at 24 hours post-injury, but returned to baseline levels at eight days. In contrast to clinical manifestation, the concussed players demonstrated a significant blood flow decrease at eight days relative to 24 hours post-injury, while the non-concussed players had no change in cerebral blood flow between the two time points.

“In eight days, the concussed athletes showed clinical recovery,” Dr. Wang said. “However, MRI showed that even those in clinical recovery still had neurophysiological abnormalities. Neurons under such a state of physiologic stress function abnormally and may become more susceptible to second injury.”

While the reasons for reduced cerebral blood flow in concussed athletes are still under investigation, the findings may have important implications for decisions on when athletes are ready to return to play after head injuries, according to the study’s principal investigator, Michael McCrea, Ph.D., professor of neurosurgery and neurology and director of brain injury research the Medical College of Wisconsin.

“For years, we’ve relied on what athletes are telling us,” Dr. McCrea said. “We need something more objective, and this technology may provide a greater measurement of recovery.”

The Medical College of Wisconsin scientists are continuing their research as one of the Phase II winners of the Head Health Challenge, an initiative from the National Football League and General Electric to develop ways to speed diagnosis and improve treatment for concussion. Dr. McCrea and his team are also co-chairing the Concussion Assessment, Research and Education Consortium (CARE) project, a major national effort that will enroll more than 30,000 college athletes, making it the largest study of concussions to date.

“The nature of this research allows us to study the mechanisms of injury and recovery directly in humans rather than in animal models,” Dr. McCrea said. “Our ultimate aim is to better understand the time course of neurobiological recovery after concussion.”

Other co-authors on the study are Lindsay D. Nelson, Ph.D., Ashley A. LaRoche, Adam Y. Pfaller, B.S., Andrew S. Nencka, Ph.D., and Kevin M. Koch, Ph.D.

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## Parental Absence Affects Brain Development in Children

### AT A GLANCE

- **Researchers have studied the effects of lack of direct parental care on brain development in children.**
- **MRI revealed larger gray matter volumes in the emotional circuits of the brain in children left in the care of relatives for more than six months.**
- **The findings indicate that lack of parental care may delay brain development.**

CHICAGO – Researchers in China have found that children who have been left without direct parental care for extended periods of time show larger gray matter volumes in the brain, according to a study being presented today at the annual meeting of the Radiological Society of North America (RSNA).

Throughout the world, due to political upheaval, economic necessity or other reasons, parents sometimes are compelled to travel away from home for months or years at a time, leaving their children behind.

In China, large numbers of workers are migrating away from their children in pursuit of better jobs. Researchers

wanted to study how this migration has affected the millions of children who have been left in the care of relatives for a period of more than six months without direct parental care from their biological parents.

“We wanted to study the brain structure in these left-behind children,” said study author Yuan Xiao, Ph.D. candidate at the Huaxi MR Research Center and the Department of Radiology at West China Hospital of Sichuan University in Chengdu, Sichuan, China. “Previous studies support the hypothesis that parental care can directly affect brain development in offspring. However, most prior work is with rather severe social deprivation, such as orphans. We looked at children who were left behind with relatives when the parents left to seek employment far from home.”

For the study, which was led by Professor Su Lui and conducted at the Second Affiliated Hospital & Yuying Children’s Hospital of Wenzhou Medical University, MRI exams from 38 left-behind girls and boys (ages 7 to 13) were compared to MRI exams from a control group of 30 girls and boys (ages 7 to 14) living with their parents. The researchers then compared the gray matter volume between the two groups and measured the intelligence quotient (IQ) of each participant to assess cognitive function.

The researchers found larger gray matter volumes in multiple brain regions, especially in emotional brain circuitry, in the left-behind children compared to children living with their parents. The mean

value of IQ scores in left-behind children was not significantly different from that of controls, but the gray matter volume in a brain region associated with memory encoding and retrieval was negatively correlated with IQ score.

Since larger gray matter volume may reflect insufficient pruning and maturity of the brain, the negative correlation between the gray matter volume and IQ scores suggests that growing without parental care may delay brain development.

“Our study provides the first empirical evidence showing that the lack of direct parental care alters the trajectory of brain development in left-behind children,” Xiao said. “Public health efforts are needed to provide additional intellectual and emotional support to children left behind by parents.”

Co-authors on the study are Lili Yang, M.D., Zhihan Yan, M.D., Yuchuan Fu, M.D., Meimei Du, M.D., and Su Lui, M.D.

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## Researchers Find Link Between Early-Stage Brain and Heart Disease

### AT A GLANCE

- **Data were analyzed from participants in the Rotterdam Study, a prospective, population-based study designed to investigate chronic diseases in an aging population.**
- **Participants in the study underwent brain MRI and blood testing to measure levels of a type of peptide that provides information on early cardiac dysfunction.**
- **Analysis revealed that higher levels of this peptide were associated with smaller total brain volume and larger white matter lesion volume.**

CHICAGO – Researchers in the Netherlands studying thousands of healthy adults have found a connection between very early stages of brain and heart disease. Results of their study were presented today at the annual meeting of the Radiological Society of North America (RSNA).

“Heart and brain diseases are big problems in aging individuals and are expected to grow even more,” said Hazel Zonneveld, M.D., M.Sc., from the Department of Epidemiology and Radiology at Erasmus University Medical Center in Rotterdam, Netherlands. “We know that myocardial infarction, heart failure and atrial fibrillation are associated with an increased risk of stroke and dementia. Our study investigates whether the heart-brain link is present at an earlier stage of disease.”

Dr. Zonneveld and colleagues analyzed data from 2,432 participants in the Rotterdam Study (57.4 percent women, mean age 56.6 years), a prospective, population-based study designed to investigate chronic diseases in Rotterdam’s aging population. Participants with overt heart disease, dementia and brain infarcts (strokes) were excluded from the analysis.

Participants in the study underwent brain MRI, which included the use of an advanced technique called diffusion tensor imaging (DTI), and blood testing to measure levels of N-terminal pro b-type natriuretic peptide (NT-proBNP), which is primarily used to help detect, diagnose and evaluate the severity of heart failure.

“NT-proBNP is released into the bloodstream in response to myocardial wall stress,” Dr. Zonneveld said. “Studies have demonstrated that NT-proBNP provides information on cardiac dysfunction even in the absence of overt heart disease.”

The researchers evaluated the brain MRI results for markers of early brain disease, including a loss of brain volume, microstructural changes and white matter lesions, which indicate areas of cells that have been damaged by injury or disease.

“Diffusion tensor imaging gives us information on the microstructural organization of the brain’s white matter,” Dr. Zonneveld said. “It is thought that microstructural brain changes precede brain changes, such as white matter lesions.”

The results of DTI showed that participants with higher NT-proBNP levels had worse microstructural organization within the white matter. A statistical analysis revealed that higher NT-proBNP levels were also associated with smaller total brain volume and larger white matter lesion volume.

“The brain volume loss was predominantly in the gray matter,” Dr. Zonneveld said.

According to Dr. Zonneveld, this study is the first to demonstrate an association between NT-proBNP and the microstructure of the brain.

“This implies that the heart and brain are intimately linked, even in presumably healthy individuals, and informs us importantly about development of disease as we age,” she said.

Co-authors on the study are Wiro Niessen, Ph.D., Aad Van Der Lugt, M.D., Ph.D., Gabriel P. Krestin, M.D., Ph.D., Oscar H. Franco, M.D. Ph.D., M. Arfan Ikram, M.D, Ph.D., and Meike W. Vernooij, M.D, Ph.D.

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