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Fetal Alcohol Exposure Affects Brain Structure in Children

AT A GLANCE

- **Alcohol use by expectant mothers can lead to problems with the mental and physical development of their children.**
- **Advancements in MRI are affording unprecedented insights into the effects of alcohol on the central nervous systems of children whose mothers drank alcohol during pregnancy.**
- **Costs for care of individuals affected by fetal alcohol syndrome in the U.S. have been estimated at \$4 billion annually.**

CHICAGO – Children exposed to alcohol during fetal development exhibit changes in brain structure and metabolism that are visible using various imaging techniques, according to a new study being presented today at the annual meeting of the Radiological Society of North America (RSNA).

Alcohol use by expectant mothers can lead to problems with the mental and physical development of their children—a condition known as fetal alcohol syndrome. Research suggests an incidence of 0.2 to 1.5 per 1,000 live births, according to the Centers for Disease Control and Prevention. Costs for care of individuals affected by fetal alcohol syndrome in the U.S. have been estimated at \$4 billion annually.

Advancements in magnetic resonance imaging (MRI) are affording unprecedented insights into the effects of alcohol on the central nervous systems of children whose mothers drank alcohol during their pregnancy. Recently, researchers in Poland used three different MRI techniques to better define these effects.

The study group included 200 children who were exposed to alcohol during their fetal stage and 30 children whose mothers did not drink while pregnant or during lactation. Researchers used MRI to evaluate the size and shape of the corpus callosum, the bundle of nerve fibers that forms the major communication link between the right and left halves of the brain, in the two groups. Prenatal alcohol exposure is the major cause of impaired development or complete absence of the corpus callosum.

The MRI results showed statistically significant thinning of the corpus callosum in the children exposed to alcohol compared with the other group.

“These changes are strongly associated with psychological problems in children,” said Andrzej Urbanik, M.D., chair of the Department of Radiology at Jagiellonian University in Krakow, Poland.

Dr. Urbanik and colleagues also used diffusion weighted imaging (DWI) to study six areas of the central nervous system in the children. DWI maps the diffusion process of water and can be a more sensitive means than traditional MRI for detecting tissue abnormalities.

Children in the alcohol group exhibited statistically significant increases in diffusion on DWI compared with the other children.

“The increase of diffusion indicates neurological disorders or damage to the brain tissue,” Dr. Urbanik said.

To noninvasively study metabolism in the brains of the children, the researchers used proton (hydrogen) magnetic resonance spectroscopy (HMRS), a common adjunct to structural MRI studies. HMRS results showed a complex collection of metabolic changes.

“In individual cases, we found a high degree of metabolic changes that were specific for particular locations within the brain,” Dr. Urbanik said.

Coauthors are Teresa Jadczyk-Szumiło, M.Sc., Monica Nardzewska-Szczepanik, M.D., Paulina Karcz, M.Sc., and Justyna Kozub, M.Sc.

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Reading, Writing and Playing Games May Help Aging Brains Stay Healthy

AT A GLANCE

- **Activities like reading a book or writing a letter can preserve brain structure in older adults.**
- **Researchers used diffusion tensor imaging to measure the movement of water molecules through the brain.**
- **More frequent cognitive activity in later life was associated with higher microstructural integrity in several areas throughout the brain.**

CHICAGO – Mental activities like reading and writing can preserve structural integrity in the brains of older people, according to a new study presented today at the annual meeting of the Radiological Society of North America (RSNA).

While previous research has shown an association between late-life cognitive activity and better mental acuity, the new study from Konstantinos Arfanakis, Ph.D., and colleagues from Rush University Medical Center and Illinois Institute of Technology in Chicago studied what effect late-life cognitive activity might have on the brain's white matter, which is composed of nerve fibers, or axons, that transmit information throughout the brain.

“Reading the newspaper, writing letters, visiting a library, attending a play or playing games, such as chess or checkers, are all simple activities that can contribute to a healthier brain,” Dr. Arfanakis said.

The researchers used a magnetic resonance imaging (MRI) method known as diffusion tensor imaging (DTI) to generate data on diffusion anisotropy, a measure of how water molecules move through the brain. In white matter, diffusion anisotropy exploits the fact that water moves more easily in a direction parallel to the brain's axons, and less easily perpendicular to the axons, because it is impeded by structures such as axonal membranes and myelin. “This difference in the diffusion rates along different directions increases diffusion anisotropy values,” Dr. Arfanakis said. “Diffusion anisotropy is higher when more diffusion is happening in one direction compared to others.”

The anisotropy values in white matter drop, however, with aging, injury and disease.

“In healthy white matter tissue, water can't move as much in directions perpendicular to the nerve fibers,” Dr. Arfanakis said. “But if, for example, you have lower neuronal density or less myelin, then the water has more freedom to move perpendicular to the fibers, so you would have reduced diffusion anisotropy. Lower diffusion anisotropy values are consistent with aging.”

The study included 152 elderly participants, mean age 81 years, from the Rush Memory and Aging Project, a large-scale study looking at risk factors for Alzheimer's disease. Participants were without dementia or mild cognitive impairment, based on a detailed clinical evaluation. Researchers asked the participants to rate on a scale of 1 to 5 the frequency with which they participated in a list of mentally engaging activities during the last year. Among the activities were reading newspapers and magazines, writing letters and playing cards and board games.

Participants underwent brain MRI using a 1.5-T scanner within one year of clinical evaluation. The researchers collected anatomical and DTI data and used it to generate diffusion anisotropy maps.

Data analysis revealed significant associations between the frequency of cognitive activity in later life and higher diffusion anisotropy values in the brain.

“Several areas throughout the brain, including regions quite important to cognition, showed higher microstructural integrity with more frequent cognitive activity in late life,” said Dr. Arfanakis.

“Keeping the brain occupied late in life has positive outcomes.”

According to Dr. Arfanakis, diffusion anisotropy drops gradually beginning at around age 30. “Higher diffusion anisotropy in elderly patients who engage in frequent cognitive activity suggests that these people have brain properties similar to those of younger individuals,” he said.

The researchers will continue to follow the study participants with an eye toward comparing the diffusion anisotropy results over time.

“In these participants, we've shown an association between late-life cognitive activity and structural integrity, but we haven't shown that one causes the other,” Dr. Arfanakis said. “We want to follow the same patients over time to demonstrate a causal link.”

Coauthors are Anil K. Vasireddi, B.S., Shengwei Zhang, B.Eng., David A. Bennett, M.D., and Debra A. Fleischman, Ph.D.

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Imaging Shows Some Brains Compensate after Traumatic Injury

AT A GLANCE

- **Researchers have identified a biomarker that may predict patient prognosis after a concussion.**
- **A special MRI technique called diffusion tensor imaging measures movement of water molecules in the brain to identify abnormalities and changes after brain injury.**
- **Concussion accounts for at least 75 percent of all traumatic brain injuries.**

CHICAGO – Using a special magnetic resonance imaging (MRI) technique to image patients with mild traumatic brain injury (MTBI), researchers have identified a biomarker that may predict which patients will do well over the long term, according to a study presented today at the annual meeting of the Radiological Society of North America (RSNA).

The results of the study showed that in some patients the brain may have changed to compensate for the damage caused by the injury.

“This finding has huge potential implications for preventing and repairing the damage that accompanies

traumatic brain injury,” said Michael Lipton, M.D., Ph.D., associate director of the Gruss Magnetic Resonance Research Center at the Albert Einstein College of Medicine and medical director of MRI at the Montefiore Medical Center, Bronx, N.Y.

According to the Centers for Disease Control and Prevention, each year in the U.S. 1.7 million people sustain traumatic brain injuries. MTBI, or concussion, accounts for at least 75 percent of all traumatic brain injuries. Following a concussion, some patients experience a brief loss of consciousness. Other symptoms include headache, dizziness, memory loss, attention deficit, depression and anxiety. Some of these conditions may persist for months or even years in as many as 30 percent of patients.

Dr. Lipton and colleagues set out to determine the post-concussion symptoms and health-related quality of life for a group of patients with MTBI one year post-injury. The researchers recruited 17 patients with MTBI from the Emergency Department of Montefiore Medical Center. Within two weeks of their injury, the patients underwent diffusion tensor imaging (DTI), which measures the direction of movement of water molecules within and along axons, which comprise the bundles of nerve fibers in the brain’s white matter.

“In a traumatic brain injury, it’s not one specific area that is affected but multiple areas of the brain connected with axons,” Dr. Lipton said.

Using DTI, the researchers measured the uniformity of water flow (called fractional anisotropy or FA) throughout the brain, pinpointing areas with low FA, which are indicative of axonal injury, and areas with abnormally high FA, as compared to healthy brains.

“Abnormally low FA within white matter has been associated with cognitive impairment in patients with TBI,” Dr. Lipton said. “We believe that high FA is evidence not of axonal injury, but of brain changes that are occurring in response to the trauma.”

One year after their brain injury, the patients completed two standard questionnaires to assess their post-concussion symptoms and evaluate their health status and quality of life.

Comparing the DTI data to the patient questionnaires, the researchers found that the presence of abnormally high FA was a predictor of fewer post-concussion symptoms and higher functioning. The results suggest that in patients who exhibit areas of high FA on DTI, the brain may be actively compensating for its injuries.

“These results offer us a new opportunity for treatment by finding ways to enhance the brain’s compensatory mechanisms.” Dr. Lipton said.

Coauthors are Sara B. Rosenbaum, B.A., Namhee Kim, Ph.D., Tova M. Gardin, B.A., Richard B. Lipton, M.D., and Molly E. Zimmerman, Ph.D.

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Researchers Discover Gender-based Differences in Alzheimer's Disease

AT A GLANCE

- **Researchers using MRI have found that Alzheimer's disease causes a different pattern of brain volume loss in men, compared to women.**
- **Women with AD initially show greater brain atrophy, but the disease progresses more quickly in men.**
- **Approximately 5.4 million Americans have AD.**

CHICAGO – All patients with Alzheimer's disease (AD) lose brain cells, which leads to a shrinking, or atrophy, of the brain. But the pattern of gray matter loss is significantly different in men and women, according to a study presented today at the annual meeting of the Radiological Society of North America (RSNA).

“We found that the extent and distribution of regional gray matter volume loss in the brain was strongly influenced by gender,” said lead researcher Maria Vittoria Spampinato, M.D., associate professor of radiology at the Medical University of South Carolina in Charleston.

According to the Alzheimer's Association, 5.4 million Americans have AD, the sixth-leading cause of death in the U.S. Currently, there is no cure for AD, which lends urgency to research efforts designed to better understand, diagnose and treat this devastating illness.

“There is a strong interest in using magnetic resonance imaging (MRI) to assess brain atrophy with the purpose of monitoring dementia progression noninvasively and to aid in understanding which factors can influence brain atrophy progression and distribution in the Alzheimer's brain,” Dr. Spampinato said.

In the study, Dr. Spampinato and colleagues analyzed data on 109 patients, including 60 men and 49 women (mean age 77), who participated in the Alzheimer's Disease Neuroimaging Initiative (ADNI), a major study that followed hundreds of cognitively healthy individuals and individuals with mild cognitive impairment (MCI) and AD over a period of five years.

During the five-year period, each of the 109 patients progressed from amnesic MCI (in which the patient suffers memory loss but maintains cognitive function) to AD. Using MR images of the patients' brains taken when they were diagnosed with AD and 12 months before and after the diagnosis, the researchers created brain maps that illustrated gray matter changes.

The brain maps revealed that compared to male patients, the women had greater atrophy in gray matter 12 months prior to their AD diagnosis and at the time of their diagnosis. The brain maps also showed that the men and women in the study lost gray matter volume in different areas of the brain as their disease progressed from MCI to AD.

“The female patients in our study initially had more gray matter atrophy than the male patients but over time, the men caught up,” Dr. Spampinato said. “In the men, the disease developed more aggressively in a shorter period of time.”

Dr. Spampinato said the gender differences in atrophy patterns have important implications for the development of therapies for MCI and AD.

“These differences should be taken into consideration when testing new drugs in clinical trials,” she said. “Knowing the difference between the male and female patterns of atrophy will help researchers better decipher a patient’s response to drug therapy.”

Coauthors are Zoran Rumboldt, M.D., Markus Weininger, M.D., Vavro Hrvoje, M.D., Karen Patrick, M.D., and Ryan O’Neal Parker, Ph.D.

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Active Lifestyle Boosts Brain Structure and Slows Alzheimer's Disease

AT A GLANCE

- **Researchers found that an active lifestyle can preserve brain structure in older adults.**
- **Lifestyle factors examined included recreational sports, gardening and yard work, bicycling, dancing and riding an exercise cycle.**
- **More than 35 million people worldwide have dementia.**

CHICAGO – An active lifestyle helps preserve gray matter in the brains of older adults and could reduce the burden of dementia and Alzheimer's disease (AD), according to a study presented today at the annual meeting of the Radiological Society of North America (RSNA).

Dementia exacts a staggering toll on society. More than 35 million people worldwide are living with the disease, according to the World Health Organization, and the prevalence is expected to double by 2030. AD is the most common cause of dementia and currently has no cure.

Cyrus Raji, M.D., Ph.D., radiology resident at the University of California in Los Angeles, and colleagues

recently examined how an active lifestyle can influence brain structure in 876 adults, average age 78 years, drawn from the multisite Cardiovascular Health Study. The patients' condition ranged from normal cognition to Alzheimer's dementia.

"We had 20 years of clinical data on this group, including body mass index and lifestyle habits," Dr. Raji said. "We drew our patients from four sites across the country, and we were able to assess energy output in the form of kilocalories per week."

The lifestyle factors examined included recreational sports, gardening and yard work, bicycling, dancing and riding an exercise cycle.

The researchers used magnetic resonance imaging (MRI) and a technique called voxel-based morphometry to model the relationships between energy output and gray matter volume.

"Voxel-based morphometry is an advanced method that allows a computer to analyze an MR image and build a mathematical model that helps us to understand the relationship between active lifestyle and gray matter volume," Dr. Raji said. "Gray matter volume is a key marker of brain health. Larger gray matter volume means a healthier brain. Shrinking volume is seen in Alzheimer's disease."

After controlling for age, head size, cognitive impairment, gender, body mass index, education, study site location and white matter disease, the researchers found a strong association between energy output and gray matter volumes in areas of the brain crucial for cognitive function. Greater caloric expenditure was related to larger gray matter volumes in the frontal, temporal and parietal lobes, including the hippocampus, posterior cingulate and basal ganglia. There was a strong association between high energy output and greater gray matter volume in patients with mild cognitive impairment and AD.

“Gray matter includes neurons that function in cognition and higher order cognitive processes,” Dr. Raji said. “The areas of the brain that benefited from an active lifestyle are the ones that consume the most energy and are very sensitive to damage.”

A key aspect of the study was its focus on having variety in lifestyle choices, Dr. Raji noted.

“What struck me most about the study results is that it is not one but a combination of lifestyle choices and activities that benefit the brain,” he said.

Dr. Raji said the positive influence of an active lifestyle on the brain was likely due to improved vascular health.

“Virtually all of the physical activities examined in this study are some variation of aerobic physical activity, which we know from other work can improve cerebral blood flow and strengthen neuronal connections,” he said.

“Additional work needs to be done,” Dr. Raji added. “However, our initial results show that brain aging can be alleviated through an active lifestyle.”

Coauthors are H. Michael Gach, Ph.D., Owen Carmichael, Ph.D., James T. Becker, Ph.D., Oscar Lopez, M.D., Paul Thompson, Ph.D., William Longstreth, M.D., Lewis Kuller, M.D., and Kirk Ericson, Ph.D.

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Too Much or Too Little Activity Bad for Knees

AT A GLANCE

- **Too much physical activity may damage knee cartilage over time, but too little activity may also accelerate degeneration.**
- **Along with the findings on changes in knee cartilage, the study also highlighted the potential of MRI-based T2 relaxation times as an early indicator of cartilage degeneration.**
- **T2 relaxation times can potentially detect cartilage changes at an earlier stage when still reversible.**

CHICAGO – Both very high and very low levels of physical activity can accelerate the degeneration of knee cartilage in middle-aged adults, according to a new study presented at the annual meeting of the Radiological Society of North America (RSNA).

Nearly one in every two people in the U.S. may develop knee osteoarthritis by age 85, according to the Centers for Disease Control and Prevention. By 2030, an estimated 67 million Americans over the age of 18 are projected to have physician-diagnosed arthritis.

Researchers at the University of California in San Francisco (UCSF) previously had found an

association between physical activity and cartilage degeneration. But that study focused on one point in time.

For the new study, the UCSF researchers looked at changes in knee cartilage among a group of middle-aged adults over a four-year period. They used magnetic resonance imaging (MRI)-based T2 relaxation times to track the evolution of early degenerative cartilage changes in the knee.

“T2 relaxation times generated from MR images allow for analysis of the biochemical and molecular composition of cartilage,” said Wilson Lin, B.S., research fellow and medical student at UCSF. “There is increased water mobility in damaged cartilage, and increased water mobility results in increased T2 relaxation time.”

The researchers analyzed 205 patients, age 45 to 60, from the UCSF-based Osteoarthritis Initiative, a nationwide study funded by the National Institutes of Health on the prevention and treatment of knee osteoarthritis. Participants used a questionnaire to record their physical activity. The researchers measured T2 values of cartilage at the patella, femur and tibia of the right knee joint at baseline and at two- and four-year visits.

According to the results of the study, participating frequently in high-impact activities, such as running, appears associated with more degenerated cartilage and potentially a higher risk for development of osteoarthritis.

“When we compared the scores among groups, we found an accelerated progression of T2 relaxation times in those who were the most physically active,” said Thomas M. Link, M.D., professor of radiology and chief of musculoskeletal imaging at UCSF. “Those who had very low levels of activity also had accelerated progression of T2 values. This suggests that there may be an optimal level of physical activity to preserve the cartilage.”

The results open up numerous areas for future inquiry, including analysis of the impact of specific types of physical activity on knee cartilage health. For instance, some of the participants in the Osteoarthritis Initiative wore an accelerometer, a device with a motion sensor to record physical activity.

“In this study, we used the subjective measure of a questionnaire,” Lin said. “The accelerometers provide a more objective way to measure physical activity.”

Along with the findings on changes in knee cartilage, the study also highlighted the potential of T2 relaxation times as an early indicator of cartilage degeneration.

“Standard MRI shows cartilage defects that are irreversible,” Dr. Link said. “The exciting thing about the new cartilage T2 measurements is that they give us information on a biochemical level, thus potentially detecting changes at an earlier stage when they may still be reversible.”

Dr. Link noted that people who have a higher risk for osteoarthritis (such as family history of total joint replacement, obesity, history of knee injury or surgery) can reduce their risk for cartilage degeneration by maintaining a healthy weight and avoiding risky activities and strenuous, high-impact exercise.

“Lower impact sports, such as walking or swimming, are likely more beneficial than higher impact sports, such as running or tennis, in individuals at risk for osteoarthritis,” he said.

Coauthors are Waraporn Srikhum, M.D., Charles E. McCulloch, Ph.D., Michael Neitt, Ph.D., John Lynch, Ph.D., Gabby B. Joseph, Ph.D., and Hamza Alizai, M.D.

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Exercise Rate Related to Improvements in Parkinson's Disease

AT A GLANCE

- **Functional MRI data showed patients with Parkinson's disease benefited from exercise using stationary bicycles.**
- **Faster pedaling led to increases in task-related connectivity between two regions of the brain associated with motor ability.**
- **Parkinson's disease is a chronic, progressive disorder of the central nervous system.**

CHICAGO – People with Parkinson's disease benefit from exercise programs on stationary bicycles, with the greatest effect for those who pedal faster, according to a study presented today at the annual meeting of the Radiological Society of North America (RSNA). Functional connectivity magnetic resonance imaging (fcMRI) data showed that faster pedaling led to greater connectivity in brain areas associated with motor ability.

Parkinson's disease is a chronic, progressive disorder of the central nervous system. Early-stage symptoms like shaking and difficulty with walking eventually may progress to cognitive and behavioral problems such as dementia. An estimated 7 to 10 million people

worldwide live with Parkinson's disease, according to the Parkinson's Disease Foundation, with most cases occurring after the age of 50.

As the disease progresses and the frequency of side effects increases, the therapeutic window begins to close. Deep brain stimulation is an effective therapy for late-stage Parkinson's disease, but is an invasive and costly procedure.

Exercise is thought to have beneficial effects on Parkinson's disease. Jay L. Alberts, Ph.D., neuroscientist at the Cleveland Clinic Lerner Research Institute in Cleveland, saw this firsthand in 2003 when he rode a tandem bicycle across Iowa with a Parkinson's disease patient to raise awareness of the disease. The patient experienced improvements in her symptoms after the ride.

"The finding was serendipitous," Dr. Alberts recalled. "I was pedaling faster than her, which forced her to pedal faster. She had improvements in her upper extremity function, so we started to look at the possible mechanism behind this improved function."

As part of this inquiry, Dr. Alberts, researcher Chintan Shah, B.S., and their Cleveland Clinic colleagues, recently used fcMRI to study the effect of exercise on 26 Parkinson's disease patients.

“By measuring changes in blood oxygenation levels in the brain, fcMRI allows us to look at the functional connectivity between different brain regions,” Shah said.

The patients underwent bicycle exercise sessions three times a week for eight weeks. Some patients exercised at a voluntary level and others underwent forced-rate exercise, pedaling at a speed above their voluntary rate. The researchers used a modified exercise bike to induce forced-rate activity.

“We developed an algorithm to control a motor on the bike and used a controller to sense the patient’s rate of exertion and adjust the motor based on their input,” Dr. Alberts said.

fcMRI was conducted before and after the eight weeks of exercise therapy and again as follow-up four weeks later. The research team calculated brain activation and connectivity levels from the fcMRI results and correlated the data with average pedaling rate. Results showed increases in task-related connectivity between the primary motor cortex and the posterior region of the brain’s thalamus. Faster pedaling rate was the key factor related to these improvements, which were still evident at follow-up.

“The results show that forced-rate bicycle exercise is an effective, low-cost therapy for Parkinson’s disease,” Shah said.

Dr. Alberts noted that that while faster pedaling led to more significant results, not all Parkinson’s patients need to do forced-rate exercise to see improvement.

“We’re now looking at this phenomenon in patients with exercise bikes in their home,” he said, “and other exercises like swimming and rowing on tandem machines may provide similar benefits.”

Coauthors are Micheal D. Phillips, M.D. (principal investigator), Erik B. Beall, Ph.D., Anneke M.M. Frankemolle, B.S., Amanda Penko, M.A., and Mark J. Lowe, Ph.D.

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Radiologic and Physical Findings Identify Elder Abuse

AT A GLANCE

- **Radiologists are beginning to identify a pattern of injuries that may be indicative of elder abuse.**
- **The analysis of abuse cases revealed that elderly victims were most often in a home setting being cared for by non-professionals.**
- **Compared to older adults who were accidentally injured, the abused elderly patients were more likely to have brain, head and neck injuries.**

CHICAGO – Radiologists in Toronto have begun to identify a pattern of injuries that may be indicative of elder abuse, according to a study presented today at the annual meeting of the Radiological Society of North America (RSNA).

According to lead researcher Kieran J. Murphy, M.D., F.R.C.P.C., F.S.I.R., interim radiologist-in-chief at University Health Network in Toronto, Canada, only 2 percent of physical elder abuse is reported by clinicians.

“Unlike cases of child abuse, there is very little information available on this subject,” Dr. Murphy said. “It’s a much neglected area.”

To aid radiologists in identifying potential cases of elder abuse, Dr. Murphy conducted a literature review and searched databases for elder abuse cases to locate radiologic evidence of the types of injuries found in abuse victims over 60 years old.

An analysis of more than 1,100 cases revealed that the most frequent injuries among abused elderly were physical trauma to the face; dental trauma; subdural hematoma, which is collection of blood in the space between the outer layer and middle layers of the covering of the brain; eye and larynx trauma; rib fractures and upper extremity injuries.

The analysis also revealed that elderly victims of abuse were most often in a home setting being cared for by non-professionals.

“In the cases we reviewed, the abused elderly were often socially isolated, depressed and unkempt,” Dr. Murphy said. “The caregivers were not only financially dependent on the elderly person in their care, they were often dealing with their own substance abuse problem.”

Compared to older adults who were accidentally injured, the abused elderly patients were more likely to have brain, head and neck injuries. Autopsy studies revealed that subdural hemorrhages were the cause of death in one-third of elder abuse cases.

“Radiologists need to be aware of the pattern of injuries frequently seen in the abused elderly,” Dr. Murphy said. “More importantly, we need to integrate the physical and radiological findings with the social context of the patient to help identify those at risk.”

Coauthors are Hussein Jaffer, M.H.A., Amanda Chan, M.S., Agnes Sauter, M.A., and Sheila Waa, M.D.

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Scatter Radiation from Mammography Presents No Cancer Risk

AT A GLANCE

- **Radiation dose to areas of the body near the breast during mammography is very low.**
- **Researchers measured the dose received by the thyroid gland, salivary gland, sternum, uterus and the lens of the eye during screening digital mammography.**
- **Thyroid shields are unnecessary during mammography and could actually result in an increased radiation dose to patients.**

CHICAGO – The radiation dose to areas of the body near the breast during mammography is negligible, or very low, and does not result in an increased risk of cancer, according to a study presented today at the annual meeting of the Radiological Society of North America (RSNA). The results suggest that the use of thyroid shields during mammography is unnecessary.

“Thyroid shields can impede good mammographic quality and, therefore, are not recommended during mammography,” said Alison L. Chetlen, D.O., assistant professor of radiology at Penn State Hershey Medical Center.

During mammography, some X-rays scatter away from the primary beam in the breast and spread outward in different directions. Although this scatter radiation is much weaker than the primary beam, there has been concern that women exposed to it during mammography could face an increased risk of cancer, especially in radiosensitive areas like the thyroid gland.

To better understand the potential impact of scatter radiation, Dr. Chetlen and colleagues set out to measure the dose received by the thyroid gland, salivary gland, sternum, uterus and the lens of the eye during screening digital mammography. Each of the 207 women in the study group wore six optically stimulated luminescent dosimeters—a device used to measure an absorbed dose of ionizing radiation—while undergoing two-view screening mammography.

Analysis of the dosimeters by a medical physicist immediately after the exam revealed that the doses to the various areas outside of the breast ranged from negligible to very low.

Absorbed radiation dose is measured in a unit called a milligray (mGy). The average estimated organ dose to the salivary gland was 0.05 mGy. The average estimated organ dose to the thyroid gland was 0.05 mGy. These doses are only a fraction of the radiation people are exposed to from natural background sources, such as cosmic radiation and radionuclides in the ground. In fact, all areas except for the sternum received less than 2 percent of annual background radiation dose.

Measured dose to the bridge of the eye and umbilicus was negligible, indicating no increased risk to the patient of cataracts or interference with normal embryonic development in early pregnancy.

“The risk of cancer induction at these low levels is indistinguishable from background incidence of cancer due to other sources,” Dr. Chetlen said.

The findings are particularly important in light of a recent increase in the incidence of thyroid cancer, one of the most radiosensitive of all cancers. The number of thyroid cancer diagnoses in women nearly doubled from 2000 to 2008, leading some to suspect that mammography may be a contributing factor and that women should wear lead thyroid shields during exams, an idea that Dr. Chetlen and other mammography experts strongly discourage.

Based on the extremely low scatter radiation dose to the thyroid—equivalent to just a few minutes of background radiation—thyroid shields are unnecessary during mammography. In addition, the researchers warn that use of thyroid shields could result in an increased radiation dose to patients.

“A thyroid shield gets in the way of the exam and can actually cause an increase in radiation dose by necessitating repeat exams,” Dr. Chetlen said.

Dr. Chetlen also pointed out that the thyroid gland is far less radiosensitive after age 30. The American Cancer Society and other organizations recommend that women have mammography screening once every year, beginning at age 40.

“In the age group eligible for screening, the thyroid gland is not very radiosensitive,” Dr. Chetlen said.

Coauthors are Steven King, M.S., Karen Brown, C.H.P., D.A.B.R., Brian Lorah, Susann Schetter, D.O., Claudia Kasales, M.D., Shelley Tuzzato, R.T.R.M., and Shelly Rambler, R.T.R.M.

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Breast Cancer Risk Estimates Increased with Repeated Prior CT and Nuclear Imaging

AT A GLANCE

- **Increased CT utilization from 2000 to 2010 may increase the risk of breast cancer for certain women.**
- **CT uses ionizing radiation in the form of x-rays to produce cross-sectional images of the body.**
- **Women should not be dissuaded from getting necessary imaging exams.**

CHICAGO – Researchers reviewing the records of approximately 250,000 women enrolled in an integrated healthcare delivery system found that increased CT utilization between 2000 and 2010 could result in an increase in the risk of breast cancer for certain women, including younger patients and those who received repeat exams. According to the study, which was presented today at the annual meeting of the Radiological Society of North America (RSNA), nuclear medicine examinations may also contribute to increased breast cancer risk.

CT uses ionizing radiation in the form of X-rays to produce cross-sectional images of the body. In nuclear medicine imaging, a radiopharmaceutical—a compound that includes a small amount of a radioactive material—is delivered inside the body to help visualize internal organs.

“When a woman undergoes CT or nuclear medicine imaging of her chest, abdomen or spine, her breast tissue will absorb some radiation,” said senior author Rebecca Smith-Bindman, M.D., professor of radiology and biomedical imaging at the University of California, San Francisco. “Breast tissue is one of the tissues in the body known to be sensitive to developing cancer as a result of radiation exposure.”

The study, led by Ginger Merry, M.D., M.P.H., breast imaging fellow at Prentice Women’s Hospital – Northwestern Memorial Hospital in Chicago, found that among the system’s female enrollees, CT utilization increased from 99.8 CT scans per 1,000 women in 2000 to 192.4 CT scans per 1,000 women in 2010 (an annual increase of 6.8 percent). In 2010, 46 percent of those CT examinations exposed the breast to radiation. Nuclear medicine imaging decreased from 39.3 scans per 1,000 women in 2000 to 27.5 scans per 1,000 women in 2010 (a 3.5 percent annual decline); however, in 2010, 84 percent of nuclear medicine studies exposed the breast to radiation.

“Until now, the impact of this increased use of imaging on radiation exposure to breast tissue and the subsequent risk of breast cancer has not been known,” Dr. Smith-Bindman said. “Our goal was to quantify imaging utilization and radiation exposure to the breast among women enrolled in an integrated healthcare delivery system and to use these data to determine the imaging-related risk of breast cancer from those studies.”

The research team collected CT dose information from 1,656 patients who underwent CT examinations that exposed the breast to radiation and, using a new automated computational method, estimated the patients' effective radiation dose and the amount of radiation absorbed by the breast. The team also analyzed the radiopharmaceutical volume and associated radiation exposure used in 5,507 nuclear medicine exams that exposed the breast to radiation.

"We found that the estimated breast radiation doses from CT were highly variable across patients, with the highest doses coming from multiple-phase cardiac and chest CT examinations, where successive images of the organ being studied are captured," Dr. Smith-Bindman said.

The researchers then estimated the women's imaging-related risk of breast cancer and compared it to their underlying risk of developing breast cancer. Each woman's 10-year imaging-related risk of developing breast cancer, beginning 10 years after her exposure to imaging and based on her age at exposure, was estimated using the breast-specific radiation data and a statistical risk model. A woman's underlying risk of developing breast cancer was estimated based on data collected by the National Cancer Institute-funded Breast Cancer Surveillance Consortium.

"Young women receiving several chest and or cardiac CTs had the greatest increased risk of developing breast cancer at approximately 20 percent," said Diana Miglioretti, Ph.D., study coauthor and senior investigator at the Group Health Research Institute. "A 15-year-old girl with no risk factors for breast cancer would double her 10-year risk of developing breast cancer at 25."

To lower imaging-related risk of developing breast cancer, Dr. Smith-Bindman said imaging providers should analyze the radiation doses associated with each exam, reduce the use of multi-phase protocols and employ dose-reduction software wherever possible to minimize exposures.

"If imaging is truly indicated, then the risk of developing cancer is small and should not dissuade women from getting the test they need," she said. "On the other hand, a lot of patients are undergoing repeat chest and cardiac CT, many of which aren't necessary. Women, and particularly young women, should understand there is a small but real potential risk of breast cancer associated with cardiac and chest CT, and the risk increases with the number of scans."

Coauthors are Choonsik Lee, Ph.D., and Eric Johnson, M.S.

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Researchers Identify Physiological Evidence of ‘Chemo Brain’

AT A GLANCE

- **Brain scans showed physiological evidence of ‘chemo brain,’ a common complaint in patients undergoing chemotherapy for cancer treatment.**
- **PET/CT demonstrated statistically significant decreases in regional brain metabolism that were closely associated with symptoms of chemo brain phenomenon.**
- **Chemo brain phenomenon is described as ‘mental fog’ and ‘loss of coping skills’ by patients who receive chemotherapy.**

CHICAGO – Chemotherapy can induce changes in the brain that may affect concentration and memory, according to a study presented today at the annual meeting of the Radiological Society of North America (RSNA). Using positron emission tomography combined with computed tomography (PET/CT), researchers were able to detect physiological evidence of chemo brain, a common side effect in patients undergoing chemotherapy for cancer treatment.

“The chemo brain phenomenon is described as ‘mental fog’ and ‘loss of coping skills’ by patients who receive chemotherapy,” said Rachel A. Lagos, D.O., diagnostic radiology resident at the West Virginia University School of Medicine and West Virginia University Hospitals in Morgantown, W.V.

“Because this is such a common patient complaint, healthcare providers have generically referred to its occurrence as ‘chemo brain’ for more than two decades.”

While the complaint may be common, the cause of chemo brain phenomenon has been difficult to pinpoint. Some prior studies using magnetic resonance imaging (MRI) have found small changes in brain volume after chemotherapy, but no definitive link has been found.

Instead of studying chemotherapy’s effect on the brain’s appearance, Dr. Lagos and colleagues set out to identify its effect on brain function. By using PET/CT, they were able to assess changes to the brain’s metabolism after chemotherapy.

“When we looked at the results, we were surprised at how obvious the changes were,” Dr. Lagos said. “Chemo brain phenomenon is more than a feeling. It is not depression. It is a change in brain function observable on PET/CT brain imaging.”

For the study, Dr. Lagos and colleagues analyzed PET/CT brain imaging results from 128 patients who had undergone chemotherapy for breast cancer. They used special software to help discern differences

in brain metabolism before and after chemotherapy. Results were correlated with patient history, neurologic examinations and chemotherapy regimens.

PET/CT results demonstrated statistically significant decreases in regional brain metabolism that were closely associated with symptoms of chemo brain phenomenon.

“The study shows that there are specific areas of the brain that use less energy following chemotherapy,” Dr. Lagos said. “These brain areas are the ones known to be responsible for planning and prioritizing.”

Dr. Lagos believes that PET/CT could be used to help facilitate clinical diagnosis and allow for earlier intervention.

Research has already shown that patients with chemo brain can benefit from the assistance of nutritionists, exercise therapists, massage therapists and counselors. In one study, cancer patients receiving chemotherapy complained of losing their ability to prepare family meals.

“When the researchers provided these patients with written and planned menus for each meal, the women were able to buy the groceries, prepare the meals and enjoy them with their families,” Dr. Lagos said.

Dr. Lagos and her fellow researchers hope that future studies will lead the way to better treatment for patients experiencing this often debilitating condition.

“The next step is to establish a prospective study that begins assessing new patients at the time of cancer diagnosis,” she said. “The prospective study has the potential to establish an understanding of the change in brain neurotransmitters during chemotherapy, which may lead to improved treatment or prevention.”

Coauthors are Jame Abraham, M.D., Gary Marano, M.D., Marc Haut, Ph.D., and Sara Kurian, M.S.

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Women with Dense Breasts Welcome Additional Screening

AT A GLANCE

- **A survey of women undergoing routine annual screening mammography found that most women with dense breast tissue are interested in supplemental breast cancer screening exams.**
- **Dense breast tissue is a strong independent risk factor for breast cancer.**
- **Seventy-six percent of women surveyed were unaware of their breast density.**

CHICAGO – A survey of women undergoing routine screening mammography found that many of them would be interested in pursuing additional screening tests if notified they had dense breast tissue, despite the possibility of false positives, invasive procedures, and out-of-pocket costs, according to a study presented today at the annual meeting of the Radiological Society of North America (RSNA).

“Our study highlights the need for patient education regarding breast density,” said Jafi Lipson, M.D., assistant professor of radiology at Stanford University School of Medicine in Stanford, Calif.

Recent studies have found that dense breast tissue is a strong independent risk factor for breast cancer. Breasts are composed of fat and fibroglandular tissue. Dense breast fibroglandular tissue appears white on a mammogram. Abnormalities and tumors also appear white on mammograms, causing them to be difficult to spot in dense breasts until the cancers are much larger and possibly in advanced stages.

“We hope this study raises awareness that dense breast tissue is a risk factor for breast cancer and that alternative technologies, including automated whole-breast ultrasound and contrast-enhanced mammography, are available to aid in screening women with dense breasts,” said Haatal B. Dave, M.D., M.S., resident physician at Yale University School of Medicine in New Haven, Conn.

For the study, Drs. Lipson and Dave surveyed 105 women undergoing routine screening mammography at an outpatient radiology clinic. The women were asked if they knew their breast density and were informed about the association between higher breast density and increased risk of breast cancer. Women were then asked a set of questions about whether or not they would be interested in additional screening tests, such as automated whole-breast ultrasound or contrast-enhanced mammography, if they found out that they had dense breasts.

Of the 105 women surveyed, 76 percent were unaware of their breast density. Forty-two percent of the women had dense or extremely dense breast tissue. A majority of the surveyed women showed interest

in the additional screening, despite the chance of increased false positives, invasive biopsy procedures and potential out-of-pocket expense.

Dr. Dave noted that educating the general public about the association between breast density and breast cancer risk is important, but that supplemental screenings are a matter of some debate in the medical and political realms. She added that many states do not require insurance companies to cover the cost for supplemental tests due to the lack of evidence of their mortality benefit.

Currently five states, including Connecticut, New York, Texas, California and Virginia, have passed bills that require radiologists to inform women of their breast density if they are found to have dense breast tissue. In 2011, a similar bill was introduced on a national level, and more than 10 other states have legislation pending. Only Connecticut and New York require health insurance companies to cover the cost of supplemental screening exams for women with dense breast tissue.

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New Studies Show Effects of Mammography Guideline Changes

AT A GLANCE

- **In 2009, the USPSTF issued controversial new guidelines recommending routine biennial screening with mammography only for women 50 to 74 years old.**
- **In one study, nearly 20 percent of cancers detected with screening mammography were among women between ages 40 and 49.**
- **Screening mammography utilization among the Medicare population declined 4.3 percent from 2009 to 2010.**

CHICAGO – Researchers assessing the impact of revised guidelines for screening mammography issued by the U.S. Preventive Services Task Force (USPSTF) found evidence that the new recommendations may lead to missed cancers and a decline in screening, according to two studies presented today at the annual meeting of the Radiological Society of North America (RSNA).

Routine screening mammography has traditionally been recommended by both the USPSTF and the American Cancer Society for all women over the age of 40. In 2009, the USPSTF issued controversial new guidelines recommending routine screening with mammography every two years for women 50

to 74 years old. In the studies being presented at RSNA 2012, researchers analyzed the impact of the new guidelines on women between the ages of 40 and 49 and the Medicare population.

“Recommendations on screening mammography are extremely important public policy and we wanted to contribute to that dialogue,” said Elizabeth Arleo, M.D., assistant professor of radiology at New York – Presbyterian Hospital — Weill Cornell Medical College in New York City. “We get questions all day long from patients and referring physicians on the appropriateness of screening mammography. The inconsistent information is very confusing for everyone.”

For her study, Dr. Arleo and a team of researchers analyzed data on screening mammography at New York – Presbyterian Hospital — Weill Cornell Medical College between 2007 and 2010. Over the four years, 43,351 screening exams were performed, which led to the detection of 205 breast cancers.

“Nearly 20 percent of cancers detected with screening mammography were found among women in their 40s, Dr. Arleo said. “It seems unacceptable to potentially miss nearly 20 percent of the breast cancers we are identifying. This, in our view, would represent a substantial degree of *under*-diagnosis.”

Of the women screened in the study, 14,528, or 33.5 percent, were between the ages of 40 and 49. Of the 205 breast cancers detected, 39 (19 percent) were found in the 40-49 age group. Of those cancers,

more than 50 percent (21 of 39) were invasive. Only three of the women between the ages of 40 and 49 diagnosed with cancer had a first-degree relative with pre-menopausal cancer.

“Our data favor the American Cancer Society recommendations of annual mammograms starting at age 40,” Dr. Arleo said.

In the second study, a team of researchers analyzed data from The Medicare Part B Physician/Supplier Procedure Summary Master Files for 2005-2010. They calculated the following annual utilization rates for screening mammography per 1,000 female Medicare beneficiaries: 2005, 311.6; 2006, 312.4; 2007, 316.2; 2008, 320.1; 2009, 322.9; and 2010, 309.1.

From 2005 to 2009, the compound annual growth rate for screening mammography utilization was 0.9 percent, compared to a 4.3 percent decline in the utilization rate from 2009 to 2010.

“There was considerable controversy over the task force guidelines, but it was unclear how much they would influence women’s choices about screening,” said David C. Levin, M.D., professor and chairman emeritus of the Department of Radiology at Thomas Jefferson University Hospital in Philadelphia. “We’re not able to tell from the data whether this significant drop in utilization was a result of women deciding to wait another year to have their mammogram, or women over the age of 74 not having the exam. But, clearly, the new USPSTF guidelines have had an effect.”

Dr. Levin said the drop in the mammography utilization rate is especially concerning, given that the 2009 rate of 322.9 per 1,000 women wasn’t particularly high.

“We’ll never see 1,000 out of 1,000 women getting a screening mammogram, but you’d like to see that number closer to 1,000, and certainly higher than 322,” he said. “We need to continue to follow these numbers and to watch the breast cancer mortality statistics.”

Coauthors of Dr. Arleo’s research are Melissa B. Reichman, M.D., Ruth Rosenblatt, M.D., Kemi T. Babagbemi, M.D., and Brittany Zadek Dashevsky, M.D., Ph.D.

Coauthors of Dr. Levin’s research are Andrea J. Frangos, M.P.H., Vijay M. Rao, M.D., Laurence Parker, Ph.D., and Richard Sharpe, M.D., M.B.A.

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CT Depicts Racial Differences in Coronary Artery Disease

AT A GLANCE

- **African-American patients with symptoms of coronary artery disease have much less fat around their hearts compared to Caucasian patients.**
- **The findings are surprising given the increased number of cardiac and metabolic disorders among African Americans.**
- **In 2010, the prevalence of coronary heart disease among African Americans was 6.5 percent.**

CHICAGO – While obesity is considered a cardiovascular risk factor, a study presented today at the annual meeting of the Radiological Society of North America (RSNA) showed that African-American patients with coronary artery disease (CAD) have much less fat around their hearts compared to Caucasian patients.

“Prior evidence suggests that increased fat around the heart may be either an independent marker of CAD burden or a predictor of the future risk of acute coronary events,” said U. Joseph Schoepf, M.D., professor of radiology and medicine and director of cardiovascular imaging at the Medical University of

South Carolina in Charleston, S.C. “You would think that African Americans, who have a higher prevalence of CAD, would have higher rates of thoracic fat in an acute chest pain setting. However, this was not the case. White patients had significantly higher thoracic fat volumes than African-American patients.”

According to the Centers for Disease Control and Prevention, coronary heart disease is the leading cause of death for people of most ethnicities in the United States. In 2010, the age-adjusted prevalence of coronary heart disease was 6.5 percent among African Americans, compared to 5.8 percent among Caucasians.

“We were very interested in finding an explanation for the racial difference in CAD and suspected differences in thoracic adipose tissue between races might be one of the contributing factors,” said Paul Apfaltrer, M.D., from the Institute of Clinical Radiology and Nuclear Medicine, University Medical Center Mannheim, Heidelberg University, Germany.

For the study, researchers evaluated cardiac dual-source CT images of 411 age- and gender-matched African-American and Caucasian patients, quantifying thoracic fat volumes, including epicardial adipose tissue (EAT)—body fat that is in direct contact with the heart—and mediastinal adipose tissue, which is body fat within the chest cavity. Results showed that while the prevalence of significant

stenosis, or narrowing of the coronary ducts, and plaque was similar in African-American and Caucasian patients, African-American patients had less fat around their hearts.

The findings, Drs. Schoepf and Apfaltrer say, are surprising, given the higher number of cardiac and metabolic disorders among African Americans despite presence of less fat in the chest cavity. The researchers suggest that EAT may actually act as a protective buffer, or that it may be related to plaque maturation including calcification, and could contribute to lower risk of acute coronary events.

“Understanding the mechanism behind the racial disparities we found may improve the prevention, risk stratification and management of CAD,” Dr. Schoepf said.

Coauthors are John W. Nance Jr., M.D., Rozemarijn Vliegenthart, M.D., Ph.D., Mathias Meyer, B.Sc., Fabian Bamberg, M.D., M.P.H., and Andreas Schindler, B.S.

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High Altitude Climbers at Risk for Brain Bleeds

AT A GLANCE

- **Mountain climbers who experience a certain type of high altitude sickness have traces of bleeding in the brain years after the initial incident.**
- **High altitude cerebral edema is a severe and often fatal condition that can affect mountain climbers, hikers, skiers and travelers at high altitudes.**
- **Mountaineers who have experienced HACE in the past should acclimatize to the altitude very slowly.**

CHICAGO – New magnetic resonance imaging (MRI) research shows that mountain climbers who experience a certain type of high altitude sickness have traces of bleeding in the brain years after the initial incident, according to a study presented today at the annual meeting of the Radiological Society of North America (RSNA).

High altitude cerebral edema (HACE) is a severe and often fatal condition that can affect mountain climbers, hikers, skiers and travelers at high altitudes—typically above 7,000 feet, or 2,300 meters.

HACE results from swelling of brain tissue due to leakage of fluids from the capillaries. Symptoms include headache, loss of coordination and decreasing levels of consciousness.

“HACE is a life-threatening condition,” said Michael Knauth, M.D., Ph.D., from the University Medical Center’s Department of Neuroradiology in Goettingen, Germany. “It usually happens in a hostile environment where neither help nor proper diagnostic tools are available.”

Dr. Knauth and colleagues at the University Hospitals in Goettingen and Heidelberg, Germany, compared brain MRI findings among four groups of mountaineers: climbers with well documented episodes of HACE; climbers with a history of high altitude illness; climbers with a history of severe acute mountain sickness (AMS); and climbers with a history of isolated high altitude pulmonary edema (HAPE), a life-threatening accumulation of fluid in the lungs that occurs at high altitudes. Two neuroradiologists assessed the brain MRI findings without knowing the status of the mountaineers and assigned a score based on the number and location of any microhemorrhages.

“In most cases, these microhemorrhages are so small that they are only visible with a special MRI technique called susceptibility-weighted imaging,” Dr. Knauth said. “With this technique, the microhemorrhages are depicted as little black spots.”

The MRI results showed brain microhemorrhages almost exclusively in HACE survivors. Of the 10 climbers with a history of HACE, eight had evidence of microhemorrhages on MRI. The other two had uncertain results. Only two of the remaining 26 climbers were positive for microhemorrhages.

“It was previously thought that HACE did not leave any traces in the brains of survivors,” Dr. Knauth said. “Our studies show that this is not the case. For several years after, microhemorrhages or microbleeds are visible in the brains of HACE survivors.”

Survivors of the most clinically severe cases of HACE had the most prominent evidence of microhemorrhages on MRI. The bleeds were found predominantly in the corpus callosum, the thick band of nerve fibers that connects the right and left halves of the brain, and showed a characteristic distribution different from other vascular diseases like vasculitis, or blood vessel inflammation.

“The distribution of microhemorrhages is a new and sensitive MRI sign of HACE and can be detected years after HACE,” Dr. Knauth said. “We will further analyze our clinical and MRI data on patients with acute mountain sickness, which is thought to be a precursor of HACE.”

In the meantime, Dr. Knauth does not think HACE survivors need to give up climbing.

“We cannot give such a strong recommendation,” he said. “However, mountaineers who have already experienced HACE once should acclimatize to the altitude very slowly.”

Coauthors are Kai Kallenberg, M.D., Peter Bartsch, M.D., and Kai Schommer, M.D.

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Note: Copies of RSNA 2012 news releases and electronic images will be available online at RSNA.org/press12 beginning Monday, Nov. 26.

RSNA is an association of more than 50,000 radiologists, radiation oncologists, medical physicists and related scientists, promoting excellence in patient care and health care delivery through education, research and technologic innovation. The Society is based in Oak Brook, Ill. (RSNA.org)

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For patient-friendly information on MRI of the brain, visit RadiologyInfo.org.

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Men with Belly Fat at Risk for Osteoporosis

AT A GLANCE

- **Visceral, or deep belly, obesity is a risk factor for bone loss and decreased bone strength in men.**
- **Most prior studies on osteoporosis have focused on women.**
- **More than 37 million American men over age 20 are obese.**

CHICAGO – Visceral, or deep belly, obesity is a risk factor for bone loss and decreased bone strength in men, according to a study presented today at the annual meeting of the Radiological Society of North America (RSNA).

“It is important for men to be aware that excess belly fat is not only a risk factor for heart disease and diabetes, it is also a risk factor for bone loss,” said Miriam Bredella, M.D., radiologist at Massachusetts General Hospital and associate professor of radiology at Harvard Medical School in Boston.

According to the National Center for Health Statistics, more than 37 million American men over age 20 are obese. Obesity is associated with many health problems, including cardiovascular diseases, diabetes, high cholesterol, asthma, sleep apnea and joint diseases. Yet despite all the health issues, it was commonly accepted that men with increased body weight were at lower risk for bone loss.

“Most studies on osteoporosis have focused on women. Men were thought to be relatively protected against bone loss, especially obese men,” Dr. Bredella said.

But not all body fat is the same. Subcutaneous fat lies just below the skin, and visceral or intra-abdominal fat is located deep under the muscle tissue in the abdominal cavity. Genetics, diet and exercise are all contributors to the level of visceral fat that is stored in the body. Excess visceral fat is considered particularly dangerous, because in previous studies it has been associated with increased risk for heart disease.

After the Osteoporotic Fractures in Men Study—a multi-center observational study designed to determine risk factors for osteoporosis—indicated that male obesity was associated with fracture risk, the researchers wanted to quantify belly fat and study its impact on bone strength.

Dr. Bredella and her team evaluated 35 obese men with a mean age of 34 and a mean body mass index (BMI) of 36.5. The men underwent CT of the abdomen and thigh to assess fat and muscle mass, as well as very high resolution CT of the forearm and a technique called finite element analysis (FEA), in order to assess bone strength and predict fracture risk.

“FEA is a technique that is frequently used in mechanical engineering to determine the strength of materials for the design of bridges or airplanes, among other things,” Dr. Bredella said. “FEA can determine where a structure will bend or break and the amount of force necessary to make the material break. We can now use FEA to determine the strength or force necessary to make a bone break.”

In the study, the FEA analysis showed that men with higher visceral and total abdominal fat had lower failure load and stiffness, two measures of bone strength, compared to those with less visceral and abdominal fat. There was no association found between age or total BMI and bone mechanical properties.

“We were not surprised by our results that abdominal and visceral fat are detrimental to bone strength in obese men,” Dr. Bredella said. “We were, however, surprised that obese men with a lot of visceral fat had significantly decreased bone strength compared to obese men with low visceral fat but similar BMI.”

The results also showed that muscle mass was positively associated with bone strength.

Coauthors are Eleanor Lin, M.D., Mary L. Bouxsein, Ph.D., Martin Torriani, M.D., Bijoy J. Thomas, M.D., Anu V. Gerweck, N.P., and Karen Miller, M.D.

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Most Patients in the Dark about What Radiologists Do

AT A GLANCE

- **In a recent survey of patients undergoing CT, more than 64 percent of respondents reported they had little or no idea what radiologists do.**
- **Print and electronic materials, advertising and social media are among the ways that some institutions and organizations have worked to increase awareness of the profession.**
- **RSNA is launching “Radiology Cares: the art of patient-centered practice.”**

CHICAGO – The role of radiologists in healthcare has long been poorly understood among the general public, but new research presented today at the annual meeting of the Radiological Society of North America (RSNA) shows that even patients who’ve had imaging exams in the past know little about the profession.

Researchers said the study findings highlight an opportunity for radiologists to educate the public about their role in healthcare.

“We know from previous studies that about half of the general public doesn’t even know that radiologists are physicians,” said Peter D. Miller, M.D., radiology resident at the Indiana University School of Medicine

in Indianapolis. “In our study, only 53.5 percent of patients who had undergone computed tomography (CT) knew that radiologists were physicians.”

The roots of the new study trace back to a speech by the late Gary Glazer, M.D., former chair of the Department of Radiology at Stanford University School of Medicine in Stanford, Calif., and Gold Medal recipient at the 2009 RSNA annual meeting.

“When we saw him speak at RSNA, it inspired us to start our own study at Indiana University School of Medicine,” Dr. Miller said.

Dr. Miller and colleagues focused on patients undergoing outpatient CT at the university hospital. During a four-month period, they asked adult patients if they would be willing to meet with a radiologist and complete two brief surveys concerning radiologists and their role in healthcare. Of the 307 patients surveyed, almost half had at least a college education or higher.

Slightly more than 64 percent of respondents reported that they had little or no idea what radiologists do. Only 35.8 percent reported having much understanding, despite the fact that almost 83 percent replied that it was important or very important to know who interprets their imaging exams. Overall

experience was reported as very positive by 70 percent of those who met a radiologist versus 53 percent of those who did not meet a radiologist.

“We need to better understand what patients want to know about radiologists in order to improve service and patient care,” Dr. Miller said. “In my experience, people who’ve had the opportunity to interact with radiologists appreciated the chance to talk with them and get their thoughts on the imaging results.”

Slightly more than 83 percent of respondents said that they were interested or very interested in receiving a copy of their radiology report. Only 2.7 percent were not interested. More than 62 percent expressed interest in having access to a website with their radiologists’ biographies and pictures.

“Many patients would like to know more about the role of radiologists in their healthcare,” said the study’s senior author, Richard B. Gunderman, M.D., Ph.D., professor and vice chair of radiology at Indiana University. “These findings present an important educational opportunity for radiology practices.”

Print and electronic materials, advertising and social media are among the ways that some institutions and organizations have worked to increase awareness of the profession. Changing the infrastructure and work process of radiology departments is another promising avenue to facilitate more patient interaction with the radiologists interpreting their imaging exams.

RSNA 2012 will host the kickoff of “Radiology Cares: the art of patient-centered practice.” The RSNA-led, physician-directed initiative was developed to promote:

- Alignment of radiology practice with patients’ needs and best interests.
- Optimal patient experience throughout the continuum of their radiologic care.
- Effective communications with patients and other healthcare providers, thus empowering patients to make informed decisions regarding their medical care.

Radiologists attending RSNA 2012 are encouraged to take the Radiology Cares pledge onsite at the meeting.

Coauthors of the research by Drs. Miller and Gunderman are Justin J. Lightburn, M.D., and David Miller, B.S., M.S.

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